Guest of Honor: WILLIAM BENHAM SNOW, M. D.

Toastmaster:
Charles F. Stokes, M. D.

Speakers:

William Seaman Bainbridge, M. D.
George Betton Massey, M. D.
Victor C. Pedersen, M. D.
A. Bern Hirsh, M. D.
Joseph Riviere, M. D.
E. C. Titus, M. D.

HOTEL AMBASSADOR, ATLANTIC CITY, N. J.

Menu

Crab Meat Cocktail, Russian Dressing

Celery *Salted Almonds* *Green Olives*

Clam Broth

Broiled Baby Lobster, Melted Butter
Between Act Potatoes

Spring Chicken on Toast Virginia
Corn Cake with Syrup *New Peas Bonne Femme*

Green Asparagus Tips, Salad Opera

Fresh Strawberry Melba
Mignardises

Demi Tasse

Testimonial Dinner

in Honor of

William Benham Snow, M. D.

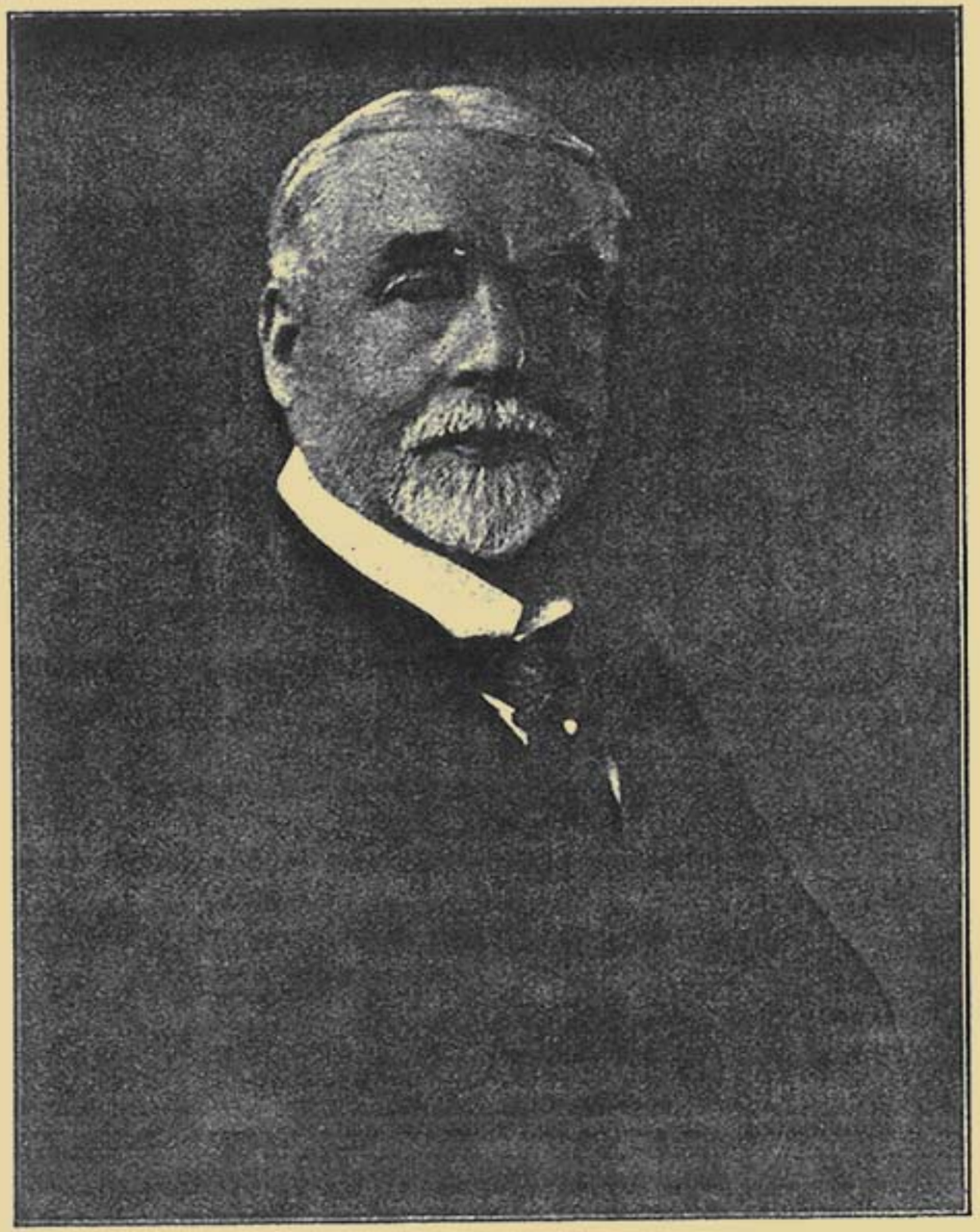
By The

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION

in Recognition of

HIS TWENTY-FIVE YEARS OF SERVICE TO THE PROFESSION AS EDITOR OF THE OFFICIAL JOURNAL OF THE ASSOCIATION

HOTEL AMBASSADOR, ATLANTIC CITY
SEPTEMBER 10, 1926



William Benham Snow, M. D.

BORN in Ashland, Greene County, New York, on October 23rd, 1860, son of Newell C. and Nancy (Benham) Snow, a descendent on both sides from Mayflower and Pilgrim stock, young Snow attended the common schools and an academic preparatory course, being awarded the State Scholarship for his own Assembly District for Cornell University. Owing, however, to a progressive form of illness—a form of muscular atrophy—he was forced to forego this opportunity, remaining under the tutelage of his pastor. For two years he taught in the public schools at the same time.

At twenty-one years of age, when the muscular atrophy was seemingly arrested, he registered at the College of Physicians and Surgeons in New York City, and graduated with degree of M. D. in 1885. He then pursued a postgraduate course in the New York Polyclinic. From 1886 to 1898, despite his physical handicap, he engaged in general practice in Ashland, Milton-on-the-Hudson and Kingston, New York.

In 1898 Dr. Snow moved to New York City where he became actively associated with Professor William James Morton and served in the clinic of the Post Graduate Medical School and Hospital. In 1898 he was appointed Clinical Assistant and later instructor in the Department of Electrotherapeutics and Nervous Diseases at the Post Graduate School, which position he held until March, 1900 when he resigned.

In 1901 Dr. Snow, with the aid of several physicians, organized the New York School of Physical Therapeutics. It continued for three years with a faculty, a full equipment of up to date apparatus and a curriculum of demonstrations, lectures and clinical instruction in methods which were not then being taught in any medical school in this country. Dr. Snow occupied the chair of static technique, general electrotherapeutics and radiotherapy, and was president of the corporation.

It had a Clinical Society, Dr. Snow still continued giving private instruction to physicians, and there is hardly a physician in this country now acquainted with physical therapeutics but owes his initial knowledge to the beloved Dr. Snow or to a student of Dr. Snow.

In January, 1902, at the request of Mr. A. L. Chatterton, the owner, Dr. Snow assumed the editorship of the Journal of Advanced Therapeutics which supplanted the Journal of Electrotherapeutics and the New York Lancet. Under Dr. Snow's editorship the Journal considered all forms of physical therapeutics. In 1901, the Journal of Advanced Therapeutics was made the official organ of The Association.

In 1917 Dr. Snow purchased the Journal and published it as the American Journal of Electrotherapeutics and Radiology until January, 1926, when the name was changed to Physical Therapeutics. During all these twenty-five years, Dr. Snow has maintained the Journal and contributed the Editorials with but few exceptions. He prepared every monthly issue, carefully editing contributions and the abstracts from current literature, a labor of responsibility. His invariable policy to bar from the publication all questionable contributions and maintain a high standard of scientific authority has become recognized by the severest critics, and in 1926, as an evidence of this, the Journal became the only accredited publication devoted to physical therapeutics recognized by the Journal of the American Medical Association.

Dr. Snow has been an active contributor to medical literature. "Currents of High Potential, High and Other Frequencies" was written in 1900. The second edition was published in 1911. His book on "Static Electricity" was first published in 1903 and "Static Electricity and Uses of the X-Ray" followed in 1904 with a second edition in 1905 which are the only standard works on the subjects of static electricity.

In 1908, Dr. Snow published in his Journal a series of chapters on "Radiant Light and Heat and Convective Heat" which was published in book form in 1909. He contributed chapters on "Electrotherapeutics and Radiant Light and Heat" to the Forchheimer's Therapeusis on Internal Diseases in Volume I and in the Second Edition of the Billings-Forchheimer's System, published by D. Appleton & Company. In the George Blumer Edition of Billings-Forchheimer's Edition, published in 1925, he contributed the Chapter on Thermotherapy, Volume I. He also contributed chapters on "Light Therapy" in the Seventh Edition of Sajous' Analytic Cyclopedia of Practical Medicine, Volume VI, and chapters on "Electrolysis, Phototherapy and Static Electricity" in the last edition of Wood's International Index Cyclopedia, and many other articles on various subjects.

He has originated numerous therapeutic methods. Some of these are, the treatment of infections by radiant heat, the relief of transudates and exudates by electrostatic charges, the treatment of poliomyelitis, sciatica, tic douloreux, locomotor ataxia, fibroids, of malignant diseases, of procidentia and subinvolution uteri, prostatitis, gonorrheal ophthalmia and many others, most of which are specifics.

THE BENHAM HOMESTEAD.

"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Tornpike, on the road turning offat Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Howell C. Snow.

about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Newell C. Snow.

THE BENHAM HOMESTEAD.

"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence,

THE BENHAM HOMESTEAD.

In
memory of
MARGARET
wife of
THOS BENHAM
SACRED
to the memory of
DR THOMAS BENHAM
who was born
JULY 18,1767
and died
FEB. 1,1849
THE FIRST DOCTOR
TO THE PIONEER SETTLERS
OF THIS AREA

In
memory of
MARGARET
wife of
THOS BENHAM
who died
APRIL 3 1844
AGED 73 YEARS
SACRED
To the memory of
DR THOMAS BENHAM
who was born
JULY 18 1767
and died
FEB 1 1849
THE FIRST DOCTOR
TO THE PIONEER SETTLERS
OF THIS AREA

POST CARD

Dear Pupil: I suppose this place is familiar to you. We had a little rain today but not to amount to much. The trees look fine. We can ill miss Lucy. Hope all of you are well.

From Minnie

Snow

Dr. William B. Snow,
#2020 Broadway,
New York City,
N. Y.

POST CARD

Dear Pupil: I suppose this place looks familiar to you. We had a little rain today but not to amount to much. The trees look fine. We can see the ships here. Hope you are well.

Miss Minnie

Dr. William B. Snow
#2020 Broadway
New York City
N. Y.

COPYRIGHT-BY
T.B. MUNSON
RESIDENCE D.B. PROUT
OWNED BY THE PROUTS 100 YEARS
PSKLAND, NY.

COPYRIGHT-12
A.B. MUNSON
RESIDENCE
OWNED BY THE PROUTS 100 YEARS
PORTLAND, NY.

THE BENHAM HOMESTEAD

"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Newell C. Snow.

Nancy Barnhart

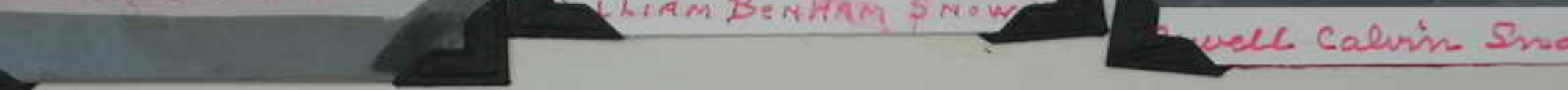
LLIAM BENHAM SNOW

LLIAM BENHAM SNOW

well Calvin Snow

Lowell Calvin Snow

"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Newell C. Snow.



"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Newell C. Snow.

COPYRIGHT-'13
T.B. MUNSON
RESIDENCE D.B. PROUTS
OWNED BY THE PROUTS 100 YEARS
ASHLAND, NY.

POST CARD

Dear Papa: I suppose this place seems familiar to you. We had a little rain today but not to amount to much. The tulips look fine. We are all very busy here. Hope you are well.

From Minnie

Snow

Dr. William B. Snow,
#2020 Broadway,
New York City.
N. Y.

RESIDENCE D.B. PROUT
OWNED BY THE PROUTS 100 YEARS
PSHLAND, N.Y.

COPYRIGHT-13
T.B.MUNSON

In
memory of
MARGARET
wife of
THOS. BENHAM
who died
APRIL 3 1844
AGED 73 YEARS
SACRED
To the memory of
DR. THOMAS BENHAM
who was born
JULY 18 1767
and died
FEB 1 1849
THE FIRST DOCTOR
TO THE PIONEER SETTLERS
OF THIS AREA

In
memory of
MARGARET
wife of
THOS BENHAM
SACRED
To the memory of
DR THOMAS BENHAM
who was born
JULY 18 1767
and died
FEB 1 1849
THE FIRST DOCTOR
TO THE PIONEER SETTLERS
OF THIS AREA

COPYRIGHT-19
T.B. MUNSON
RESIDENCE
OWNED BY THE PROUTS 100 YEARS

COPYRIGHT-'13
T. B. MUNSON
RESIDENCE
OWNED BY THE PROUTS 100 YEARS

RESIDENCE D.B. PROUT
OWNED BY THE PROUTS 100 YEARS
ASHLAND, N.Y.

RESIDENCE — D.B. PROUT

OWNED BY THE PROUTS 100 YEARS

ASHLAND, N.Y.

THE BENHAM HOMESTEAD.

"Aaron Claflin and family settled on a farm entirely new, about a mile and a half from the Turnpike, on the road turning off at Mr. Snow's." Dr. Jacob Benham's residence, inherited by his daughter Nancy, Mrs. Newell C. Snow.

Nancy Barham

LLIAM BENHAM SNOW

Lowell Calvin Smoot

Lowell Calvin Snow

A MANUAL OF

ELECTRO-STATIC MODES OF APPLICATION

AND

THERAPEUTICS

BY

WILLIAM BENHAM SNOW, M. D.

Professor of Electro-Therapeutics, Radiography, and Radiotheraphy in the New York School of Physical Therapeutics, Editor of the Journal of Advanced Therapeutics, and late Instructor in Electro-Therapeutics in the New York Post-Graduate School, etc.

NEW YORK

A. L. CHATTERTON & CO.

COPYRIGHT, 1902,

BY

WILLIAM BENHAM SNOW.

THE MERSHON COMPANY PRESS,
RAHWAY, N. J.

TABLE OF CONTENTS.

CHAPTER I.

PAGE

Introduction, ... 5

CHAPTER II.

Appliances for Administration, ... 10
The Static Machine, ... 10
The Holtz Machine with Wimshurst, ... 10
Necessary Electrodes, ... 12
Electric Motor, Current Controller, etc., ... 14

CHAPTER III.

Care of the Machine and Management during Periods of Humidity, ... 15

CHAPTER IV.

Disruptive Methods of Static Administration, ... 18
Charging the Machine, ... 18
The Polarity, ... 20
The Ground Connection, ... 20
The Employment of Sparks, ... 21
The Indirect Spark, ... 24
The Direct Spark, ... 25
The Friction Spark, ... 25
The Leyden Jar Spark, ... 26

CHAPTER V.

The Convective Forms of Administration, ... 26
Static Electrification, ... 26
The Static Breeze, ... 27
The Static Spray, ... 28
The Static Brush-Discharge, ... 28

CHAPTER VI.

Conductive Discharges, ... 30
The Static Induced Current, ... 31
The Wave Current, ... 36

CHAPTER VII.

Physiological Actions, ... 46
The Local Effects, ... 48
The Constitutional Effects, ... 51

CHAPTER VIII.

General Principles of Electro-Static Administration and Therapeutics, ... 52
The Patient, ... 52
The Dosage, ... 54
The Frequency of Administration, ... 55

CHAPTER IX.

Electro-Therapeutics of Inflammatory Conditions, ... 57
Sprains and Bruises, ... 58
After a Fracture, ... 59
Rheumatism, ... 60
Myalgia, ... 63
Gout, ... 63
Rheumatoid Arthritis, ... 64
Osteo-Arthritis, ... 67
Synovitis, ... 68

CHAPTER X.

The Painful Neuroses, ... 69
Neuritis, ... 69
Sciatia, ... 70
Neuritis within the Pelvis, ... 72
Brachial Neuritis, ... 73
Locomotor Ataxia, ... 74

CHAPTER XI.

Neuralgia, ... 79
Coccygodynia, ... 80
Intercostal Neuralgia, ... 81
Facial Neuralgia, ... 81
Neuralgia of the Foot, ... 82
Visceral Neuralgia, ... 83
Gastralgia, ... 84
Cardialgia, ... 84
Ovarian Neuralgia, ... 84
Neuralgia of the Rectum, ... 85
Neuralgia of the Testicle, ... 85
Migraine, ... 85
Headache, ... 87

CHAPTER XII.

General Treatment of Paralysis, ... 87

CHAPTER XIII.

Pathological Muscular Contractions, ... 96
Epilepsy, ... 97
Convulsive Tic, ... 98
Blepharospasm, ... 98
Chorea, ... 99
Hiccoughs, ... 99
The Occupation Neuroses, ... 99
Contractures, ... 100
Athetosis, ... 101
Torticollis (wry neck), ... 102
Spasmodic Torticollis, ... 102
Tremors, ... 102
Asthma and Hay Fever, ... 103

CHAPTER XIV.

Static Electricity in Dermatology, ... 103

CHAPTER XV.

Psychical and Functional Neuroses, ... 107
Neurasthenia, ... 108
Hysteria, ... 114
Hypochondriasis, ... 115
Melancholia, ... 117
Functional Insanity, ... 117

CHAPTER XVI.

Miscellaneous Diseases, ... 119
Tuberculosis, ... 119
Chlorosis and Anæmia, ... 121
Diabetes Mellitus, ... 122
Bright's Disease, ... 122
Congestion of the Liver, ... 123
Myasthenia Gastrica, ... 124
Exophthalmic Goiter, ... 124
Simple Goiter, ... 125
Conclusion, ... 125

LIST OF ILLUSTRATIONS.

FIG.		PAGE
1.	TYPE OF A MODERN AMERICAN HOLTZ-WIMSHURST INFLUENCE MACHINE,	11
2.	STATIC ELECTRODES,	13
3.	SPARK DIRECTOR,	24
4.	MORTON SPARK DIRECTOR,	24
5.	MUFFLER,	27
6.	BRUSH ELECTRODE,	27
7.	REPRESENTATION OF D'ARSONVAL CURRENT,	32
8.	REPRESENTATION OF STATIC INDUCED CURRENT,	32
9.	CLEAVES RHEOSTAT,	33
10.	REPRESENTATION OF TESLA CURRENTS,	34
11.	REPRESENTATION OF MORTON WAVE CURRENT,	37
12.	REPRESENTATION OF MORTON WAVE CURRENT AND AN INSULATED EXTERNAL CAPACITY,	37
13.	SHOWING A MODIFIED WAVE CURRENT,	39
14.	SHOWING A MODIFIED WAVE CURRENT,	40
15.	SHOWING A MODIFIED WAVE CURRENT,	41
16.	DESIGN FOR SHEET-METAL ELECTRODES,	66
17.	SKIAGRAPH SHOWING RESULTS OF OSTEO-ARTHRITIS,	68
18.	MAPLE-WOOD, GLASS-COVERED ELECTRODE,	106

PREFACE.

A careful review of the literature treating of static electro-therapeutics, including comments and treatises of recent dates, discovers no work which will guide the practitioner first undertaking to operate a static machine in many important procedures. One only (Hedley) gives more than a suggestion of the most recent and (we will be borne out later if not at once in saying) most valuable of all forms of electric administration—the Morton wave current.

Hedley gives an outline descriptive of the method, but no allusion to its therapeutic value and indications. Others devote considerable space to the "static induced," or what some choose to call the "leyden-jar current," but lose sight of the best of all currents.

The writer's association with the ablest living authority on static electro-therapeutics, Professor William J. Morton, M. D., of New York, and familiarity with his work at the time the "wave current" was developed, afforded him an opportunity to make many experiments which have helped to demonstrate its great value. We feel justified, therefore, in adding to the present literature a practical work covering some of the gaps not filled in by others. It will be the aim of the writer to make clear, concise, and explicit all practical methods of administration, devoting as little space to pathology, diagnosis, and the study of disease as is deemed necessary to clearly define the course of treatment. Those who care to know more of the physics are referred to the standard works on the subject.

STATIC ELECTRICITY—THERAPEUTICS, MODES OF ADMINISTRATION, AND SKIAGRAPHY.

CHAPTER I.

INTRODUCTION.

The growing interest in the electro-static treatment of many forms of disease arises from the results obtained, in many instances so startling that to gain the credence of a confrere often requires that he witness the administrations; and of the operator that he have confidence in the veracity of the patient, and his own diagnosis. Many physicians themselves have proved excellent subjects for demonstration.

The development of this now most valuable department of electro-therapeutics has advanced step by step with the evolution to perfection of the modern static machine. In England and on the continent of Europe, where at present no such machines are produced as the American apparatus, static electro-therapeutics is not advanced; and the physicians of this country who look abroad for advanced ideas do not easily discover progress at home. In the recent writings of Hedley, Jones, and Bordier the subject receives but brief consideration, Jones acknowledging that the American machines are superior to others.

Since the introduction of electricity in medicine there have been progressive improvements in methods and the development of more perfect apparatus adapted to special applications and indications. The crude galvanic batteries, made without reference to size of elements or number or arrangement of

cells, and having no means for regulating the current, have been succeeded by batteries designed for special uses, and associated with rheostat for controlling and milliampere meter for measuring the current, thus enabling the operator to make intelligent and safe use of an agent capable of doing serious mischief.

With the same progress of the science marked changes in the character and utility of the faradic battery have been evolved. The first crude affairs, having short, coarse secondary coils and indifferent device for interrupting, have been succeeded by the perfected instruments, having long, fine wire secondary coils, and varied devices for fine, slow, or rapid interruptions. The perfecting of these forms of electrical apparatus have worked most striking changes from time to time in the medical mind. Principles have been set up based upon some theory of an authority, to be later disproved. Gradually the peculiar polar effects of the constant current have become established, and electrolysis, cataphoresis, and cauterization have become its chief fields of usefulness. Little is it valued to-day as an anodyne, tonic, or reconstructive alterative. Faradism has superseded it; only to be superseded by more effective currents. As apparatus has been produced generating currents of greater and greater voltage and relatively very small amperage, results have been obtained leading on to the introduction of new and more perfect machines.

The sinusoidal machine in sanatoria and office practice has effected results impossible to obtain from the faradic battery. In France the great frequency high potential apparatus of d'Arsonval is still further an advance. In 1881 Dr. Morton published the first of what he pleases to call the "spark-gap" currents, the "static-induced current"; and later, in 1899, the "wave current." Until the introduction of these static currents, administrations had been limited chiefly to spark electrization, breeze and brush discharge; all useful in selected cases. The static currents have the greatest voltage and least amperage of any currents to-day employed in medical practice, and produce many effects—especially the wave current—not to be derived from other currents.

Relative merits of currents and uses of various apparatus should be briefly considered in passing, as the body of this work will deal exclusively with static administrations. We maintain that in all cases not calling for the peculiar polar actions of the constant current, the static currents, when they can be administered, are to be preferred to all others. The great point of superiority of the wave current lies in the fact that it is a *one pole* current of high or low potential, and great or small frequency, under perfect control, painless during administration, potent for good, and not endangering the life of the patient. The patient, being insulated, is repeatedly charged and discharged from the surface of contact with the electrode, obtaining a local effect and the constitutional effects of general electrization peculiar to a one-pole current.

The *two-pole, static-induced current,* which has received much more recognition because it has been longer known, is of relatively little value, and the writer knows of no indications for its substitution for the wave current. *Static sparks, brush discharge, breeze and static insulation* each meet valuable indications, and all partake of the characteristics in common with the wave current. They are administered with the patient insulated, and are often called currents, though they are not in the technical sense of the term, the resistance of the dielectric permitting the body to become charged before it escapes.

The currents of the great-frequency, high-potential apparatus of d'Arsonval are two pole currents transformed from the street current, and of relatively large amperage, and dangerous when administered in currents of more than 1500 volts. The therapeutic effects, while surpassing all but the static currents, accomplish nothing that they do not (except, possibly, as some authorities claim, a destruction of germ life) and fail absolutely where the wave current succeeds. The apparatus is elaborate, expensive, and apt to get out of repair, as are most coils and transformers.

The current generated by the sinusoidal machine, adapted only to sanitarium or office practice, does not approach in value the d'Arsonval currents, but gives generally better re-

sults than the faradic. The current is of relatively higher voltage and greater amperage than the latter, and a much more agreeable current. It has no advantage over the wave current, and will not be called into requisition when the static machine is at hand.

The faradic apparatus, while a relatively feeble agent, will be called into service at the bedside or home of the patient where in but rare instances it will be possible to have more elaborate generators present. It will be of value in connection with a galvanic battery in testing for nerve degeneration. If a faradic battery is expected to be of service it should have not less than 1500 yards of fine wire in its secondary coil, and be provided with a fine ribbon or other device for rapid interruption. When we consider the marked improvement in these instruments over the ancient ones, and take note how greatly inferior they are to other apparatus, it is not surprising that electricity has so often proved disappointing, or that the mass of the medical profession are skeptics.

The discovery of the Roentgen ray, followed by the prompt adaptation of the static machine to its production, has given Franklinism another field, which is bound to redound to the benefit of two sets of physicians. Those who were already possessors of static machines have had thrust upon them a great aid in making a differential diagnosis, diagnosing incipient phthisis before any other examination can discern it, localizing an aneurism, stone in the kidney, the presence and site of foreign bodies, fractures, dislocations, etc., as well as its therapeutic uses in a field now becoming rapidly recognized. The other set are those who for purpose of employing the X-ray have now at hand, or may have, a means of doing very much valuable therapeutic work that could not be done as well by any other method. So true are these facts that, if for no other reason, one purchasing an X-ray apparatus should select the static machine; but there are other reasons:

1. The machine does not have the same tendency to shorten the life of the tube, due to the fact that the radiance is produced by a current of such low amperage that the heat production is reduced to a minimum, with practically no danger of melting the metal parts.

2. The radiance is far more constant and uniform, not having the flicker characteristic of the coil apparatus, which feature is invaluable in making fluoroscopic examinations of the chest.

3. In the case of the static machine there is no coil to burn out, a saving of suspense and expense.

On the other hand the coil apparatus has some features of advantage which it is but fair to name:

a. Portability.—Some inferior forms of apparatus (inferior because the generator of the current of sufficient utility is not portable) are constructed to make it possible to convey them to the patient.

b. Weather conditions, which will occasionally (not often) affect the output of current from the static machine, do not affect the coil apparatus. As will be shown in later pages, this difficulty may be entirely obviated.

We know of no other advantage possessed by coil apparatus, for a careful study of results shows that in skilled hands equally good skiagraphs are taken by either, while with amateurs, absence of fear of damaging the apparatus, either injuring the tube or burning out a coil, leaves the chances of obtaining good results in favor of the static machine.

So valuable is static electricity in treating a multitude of cases in every hospital and insane asylum in the land, and the grave mistake of placing a coil apparatus that will debar the purchase of a static machine so apt to occur, that the writer, without prejudice, interest, or bias other than the good of humanity cannot too strongly urge that the additional first cost is unworthy of consideration.

If some electrical engineer will solve the difficult problem, and manufacture a coil apparatus not apt to burn out—one which will produce the current having the very small amperage and great potential of the static currents, that apparatus will be most acceptably received.

CHAPTER II.

APPLIANCES FOR ADMINISTRATION.

The Static Machine.—Success in static administrations requires a machine constructed in accordance with right principles and of the proper materials. Many machines on the market and extensively advertised are not so constructed, and are sure to disappoint the physician who, later, sees a more perfect apparatus, or discovers, as many have already, that he does not get the results obtained by others.

1. *The Holtz machine,* with *Wimshurst* conveniently placed within the case for charging, is the best type of influence machine.

2. The machine should have at least eight properly coated glass *revolving* plates, 30 to 34 inches in diameter, if to be used for medical work and *incidentally* for X-ray work, or ten plates if X-ray work is expected to be a main *feature* as well as medical work. (Very satisfactory skiagraphs are taken with eight-plate machines.) The amperage or quantity of current generated under favorable conditions is measured by the number of revolving plates and the speed of the machine; and the voltage, indicated by the length of spark, by the diameter of the plates, and speed of the machine. (The spark generated can never exceed, and under the best conditions may equal, one-half the diameter of the plate.

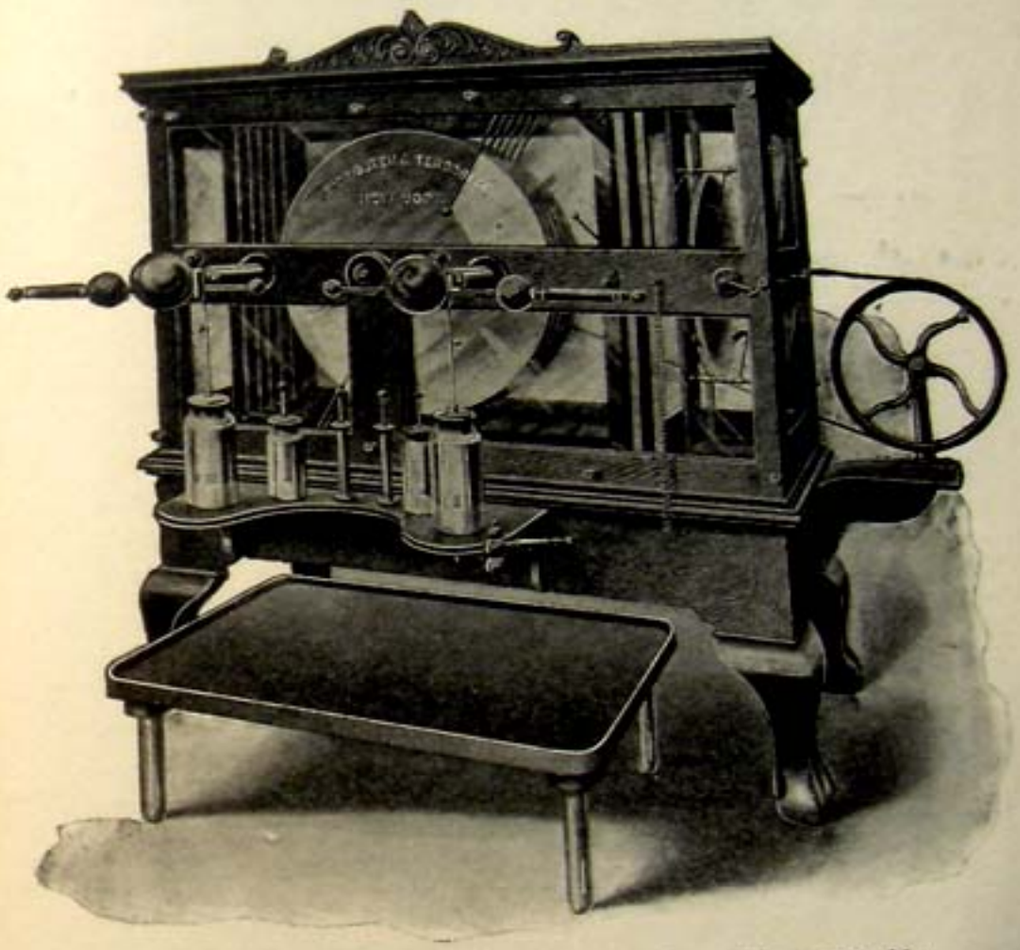
3. The interior construction of the machine should be of vulcanite where insulation is indicated, because wood is not a non-conductor of static electricity.

4. The mechanism should be inclosed, so far as possible, within a case constructed from thoroughly seasoned wood, the pores of which have been well-filled with filler, oil, and shellac, that air cannot penetrate or moisture affect it, and inclosed in such a manner as to be effectually sealed against the influences of the atmosphere.

5. The case and all exposed metals should be free from points and angles, all parts being rounded to prevent leakage.

6. The Leyden jars should be portable, and not attached to

the machine, because they are in the way, collect dust, and are of use only in connection with the little used static-induced current.



A Type of a Modern American Holtz-Wimshurst Influence Machine.

7. A provision (invaluable under unfavorable atmospheric conditions, or when, through neglect, the machine has accumulated dampness) by which the speed of the Wimshurst may be accelerated, and the Holtz, at first started at a slow speed, may suddenly be made to move rapidly to catch the charge. (See "Charging the Machine.")

8. A provision, or receptacle, for containing some chemical, as Ca Cl^2 or Ca O, for drying the air in case it should become moist, will be a valuable feature and generally appreciated by the profession.

9. The insulated platform should be neither too large nor too small—about two feet three inches by three feet six inches, and provided with glass, porcelain, or vulcanite legs not less than ten inches in length, to prevent escape of electricity to the floor.

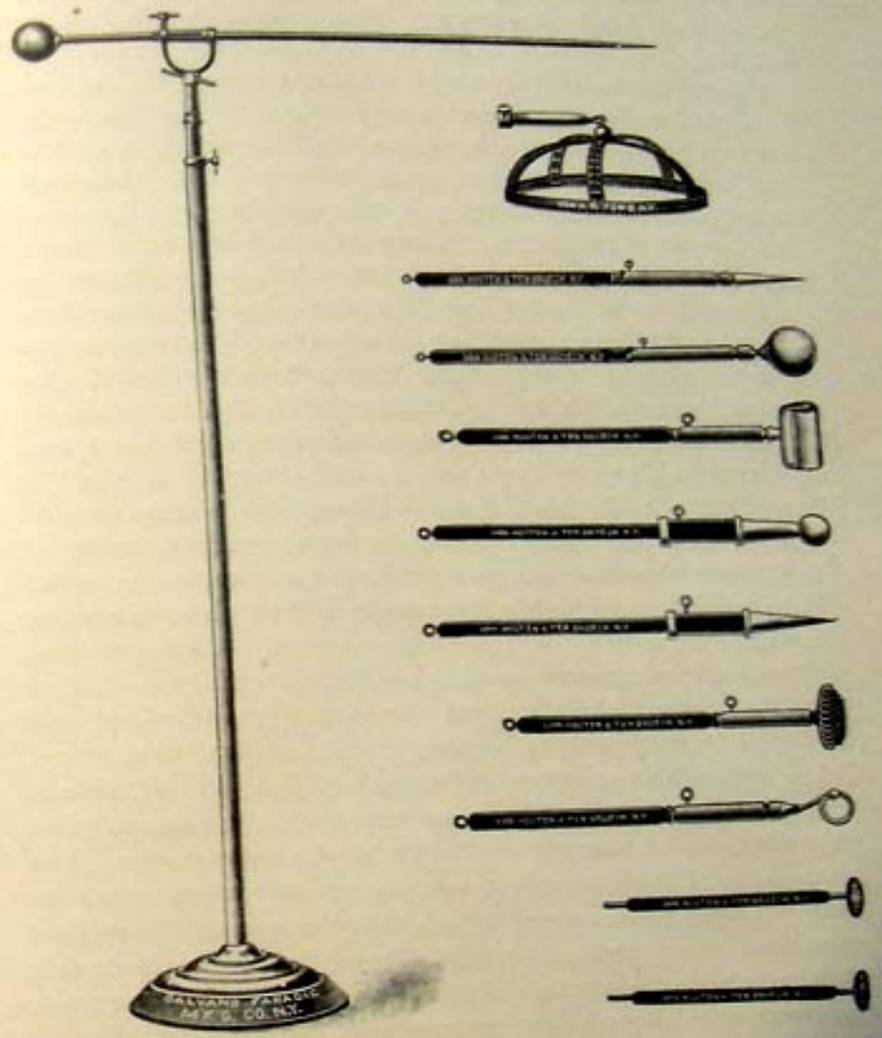
10. A test of the efficiency of a machine is not the length of spark discharged when the Leyden jars are employed, the length of spark depending on the size and coating of the Leyden jars. The frequency and regularity with which the discharges are repeated will be the test both of a machine's capacity and the absence of leakage under high tension, qualities invaluable in a machine for X-ray work and use of the wave current.

11. Only small Leyden jars are of any use in practice, and they for administering the static-induced current, unless a transformer is to be used.

12. A chair might be devised having a high back, capable of folding, and provided with wooden stirrups, for gynecological and rectal administrations.

The necessary electrodes and instruments for use are constantly increasing in number with the broadening field of application following upon the introduction of the wave current.

The common electrodes and instruments for general-purpose work should be three *ball electrodes* having diameters of 2 to 2 3-4 inches, 1 1-2 inches, and 1-2 inch respectively; *one roller* (of most value for rolling out sheet tin electrodes); one *metal-point electrode;* one *chain holder* (for holding chain during administration of the direct spark, breeze, or brush discharge; one *adjustable stand* for holding long-point electrode; one *wooden-point electrode;* and one *wooden-ball electrode,* for administering brush discharge. *A wooden electrode having a movable insulated guard,* for use within cavities, as the nose, mouth, ear, and vagina will be found serviceable in special cases. *Block tin sheets,* of different thicknesses, of which 22 gauge and 32



Standard, with Combination Ball-point electrode and Crown, and Set of Electrodes.

gauge will be found most desirable, may be easily cut with a pair of shears into shapes and sizes indicated for various applications of the wave current. For inter-uterine, vaginal, rectal, and urethral administrations of the wave current and static-induced current *special electrodes* are designed, and will be described later. *A rectangular metal plate* (aluminum) twelve by fifteen inches, having a chain attached, is of sufficient value to call for its addition to every outfit. *The static cage*, while of doubtful efficacy, may be demanded by some. Two *sponge electrodes*, for using the static-induced currents, are usually included. *A current controller*, for administering the static-induced current, will make the administration of that current much more agreeable and effective. A *crown* or *tassel electrode*, for administering breeze to head, will be demanded by some. A *muffler*, for deadening the sound during the administration of the spark-gap currents, must be at least six inches in diameter, and made so that it can be dried daily. Rheophores, for connecting the wave-current electrodes with the machine, having a sliding device for shortening, and clasp for holding the electrode, will be found a great convenience.

The appliances for use in skiagraphy will be given in another chapter.

An *electric motor* and *current controller*, a *water motor*, or *gasoline engine* (which last may be placed in the cellar) will be found indispensable if the best results are to be obtained. It is impracticable and impolitic for a physician to endeavor to turn the machine himself, and the presence of a man is often objectionable. A current controller, to be satisfactory, must be capable of regulating the motion gradually, from a very slow to a very rapid rate of speed, that the operator may thus regulate the frequency and potentiality of the spark, the length of the spark, or the radiance of his X-ray tube. A *hygrometer*, to determine whether a deficient output of the machine is due to humidity or the condition of the machine, will often prove a satisfaction, but is not a necessity.

There may be various other attachments suggested, but the above will meet most demands.

CHAPTER III.

CARE OF THE MACHINE AND MANAGEMENT DURING PERIODS OF HUMIDITY.

Location of the Machine.—A damp house, either on account of improper construction, as is the case with many of the older brick houses, or from location with reference to the exclusion of sunlight, will cause no little trouble, and eventually ruin a static machine, if the most constant care is not exercised. It is of first importance, then, that a machine be placed in a properly constructed and well-located house. A room on the sunny side of the house, if convenient, will add another marked advantage in caring for the machine.

It must be borne in mind that, regardless of what manufacturers say, during periods of humidity moisture will get into the case, and, furthermore, if it should not, the air as it becomes more and more saturated with moisture, will finally conduct away the electricity as rapidly as it is excited, and the patient get little or none. This is due to conditions not met with in other electric currents, and therefore little appreciated by those unfamiliar with the use of static electricity. The conditions arising during periods of humidity are: (1) The moisture gradually creeps into the machine and interferes seriously with the excitation of the electric currents. (2) If conditions within the case permit the excitation of the currents, the air, no longer acting as a dielectric, spirits away the electricity of very great potential and infinitesimal amperage. (3) The consequence is the patient is not treated or the Crookes tube excited. The first difficulty may be obviated or remedied in several ways, and deserves attention because the maximum current excited insures the delivery of the largest possible amount to the patient.

To remedy some of this difficulty there are various methods.

(1) Some prefer to keep no chemicals within the case for the purpose of absorbing the moisture as it may accumulate, but use means to get rid of it when necessary. An easy method is to fill a large fruit jar with well-mixed, finely cracked ice and

salt, in about equal parts, and having wiped the surface dry, quickly place it upon a plate within the case, and promptly close. The moisture within the case rapidly condenses upon the surface of the jar, and in less time than by any other method the moisture is condensed, the air dried, and the machine will charge. This procedure may be repeated from time to time, and no other means be employed except ventilating it on dry days.

(2) Many of the most successful operators place vessels containing dry calcium chloride within the case, allowing it to remain, and remove it only when it becomes wet for purpose of drying (which may be done in an oven or over an oil or gas stove) or replacing it by fresh. Others only make use of an absorbent during the summer months.

(3) Quicklime is preferred by many, but should be used in greater bulk and in vessels carefully covered with gauze to prevent the fine dust from flying about the machine. To the writer this seems the least objectionable of absorbents, and need only be employed during the months when humidity interferes. Use from ten to twenty pounds, changing about once monthly, when the machine should be opened top and ends and thoroughly aired out to get rid of the accumulated ozone, which will attack the hard-rubber and metal parts of the machine. Choose a dry day for changing the lime and airing the machine, and no interruptions will arise.

(4) It has been suggested that the machine may be dried out by placing a small electric heater within the case and closing it. When we reflect that heat does not consume, but rather increases the capacity of the air to hold moisture, what can be gained, unless an exit is provided for the escape of the heated air, and a source created for dry air which may flow in to take its place? For the present we believe electric stoves will be little used in this connection.

(5) A provision that precludes the necessity of any of the above measures, except removing the ozone from the case, is to keep the temperature of the operating room at 60° to 70° F. during periods of humidity, when the machine will always do good work, and the air remain so dry as not to interfere with

the administrations to the patient. This is accomplished as in refrigerators employing condensed CO_2. The gas is passed through a series of condensing pipes communicating with a cylinder of liquid CO_2. A device provided with a thermostatic rod may be so adjusted as to automatically maintain any desired temperature. With such a provision the moisture within the room is condensed upon the pipes and the room is cooled. Wherever any plan is introduced that will maintain the above temperature of the operating rooms, it will be possible to obtain the best results at all times and seasons. There are but few localities where the necessities for such measures will arise except for a few days during the heated season. In the sanitaria and hospitals of the country the need will be most felt, when, as time goes on, the real value of static electricity becomes appreciated and its adoption is universal.

Before finishing this chapter it is well to consider what to do if the machine has become useless from accumulation of moisture on the revolving and stationary plates. If the manufacturer is in the town, call upon him. If not, do not despair, for common sense and a little patience will succeed in making it work as well as a new one. The machine is simply to be dried out. For this purpose there is no better agency than the direct rays of the sun. Remove the top and ends of the machine and place it where the sun can shine upon it for several hours, and nothing more may be required. Or a yardstick about one end of which is wound a piece of dry chamois, will remove much of the moisture, if the parts are carefully wiped out. After this it would be well if the machine could stand for a short time in the direct sunlight. If, however, it is not convenient, employ one of the other measures for drying it out.

The metal parts—the prime conductors, discharging rods, and small balls—should be kept well polished and free from dust, to prevent the escape of electricity from the multitude of small points which thus accumulate.

Carefully note from day to day the condition of the interior of the machine, and adjust the plates or combs whenever friction of the parts is discovered. The chafing of the revolving plates against the stationary ones, if not otherwise discovered,

will be indicated by white spots near the circumference of the revolving plates. It may often be necessary to remove the top of the case to locate and correct the trouble. No special mechanical skill is required to make such adjustments. The greatest annoyance when the case is first opened, however, will be occasioned by the irritating ozone which accumulates within. If the weather conditions are favorable, it is always best to let the ozone escape before correcting the trouble, otherwise take care not to inhale the gas, for though not dangerous it will induce paroxysms of coughing and discomfort which may last for hours. Whatever the character of the bearings, keep them well oiled. This injunction should not be necessary, but it is often neglected and easily avoidable damage done to the only part of the machine subjected to friction and liable to wear. With proper care, a well-constructed static machine will endure for as long a period of time as any physician will want to use it, and always operate satisfactorily.

CHAPTER IV.

THE DISRUPTIVE METHODS OF STATIC ADMINISTRATION.

Charging the machine, which is a prerequisite to every form of static application, under favorable atmospheric conditions, when the machine is in good order, is but the matter of a moment's time. In fact a machine in good condition, which is used every day, may not discharge for months, if care is taken to leave the discharging rods widely separated. If, however, moisture has gotten into the machine, or during periods of humidity, it will often tax the skill, patience, and energy of an adept to accomplish it.

(1) Make the necessary connections, which vary with different makes of machines, to place the Wimshurst in circuit with the Holtz.

(2) Separate the balls of the discharging rods about one-half inch and give the Wimshurst several vigorous turns before starting the Holtz (if the Wimshurst is operated by hand).

(3) Next start the machine, at the same time moving the

Wimshurst rapidly, and almost instantly a torrent of sparks will pass and continue when the Wimshurst is at rest—the machine is then said to be charged.

(4) Cut the Wimshurst out of circuit and gradually separate the discharging rods; allowing the machine at the same time to run rapidly until a maximum charge is obtained.

If, as in machines of some manufacture, the Wimshurst is operated by the same power as the Holtz, both will start at the same instant, and under favorable conditions the machine will instantly charge. It is under the unfavorable conditions referred to that a few suggestions will prove of value; and it is then that it is better to have the Wimshurst under manual control.

If due to the condition of the machine, a problem which the hygrometer will determine, for if not due to the atmospheric conditions the fault must be with the Holtz or Wimshurst or both, after ten minutes' effort, employing the following maneuvers, prepare to put the machine in order and either replace the wet calcium by fresh, rebake it, or put in fresh lime; or, at this time, if the machine is in great demand, resort to the cracked ice and salt (see Care of Machine).

The maneuvers which succeed often under difficult conditions are the following:

(1) When the Wimshurst fails to give the usual one-half inch or longer spark, if revolved several times in the opposite direction, and then reversed, the current may be promptly excited.

(2) If, when rapidly moved, the Wimshurst will not generate a spark between the balls of the discharging rods at least three-eighths of an inch in length, it will cost a struggle to get the charge. One-half inch will usually succeed.

(3) Having carefully removed with a dry cloth or chamois all dust or moisture from the exposed metal parts of the machine in connection with the circuit, separate the balls of the discharging rods as far apart as a spark will pass when the Wimshurst is revolving rapidly. While rapidly turning the Wimshurst start the Holtz, at first slowly, at the same time, little by little increasing the length of the spark-gap, when

after an instant, if sparks continue to pass between the balls, suddenly increase the speed of the Holtz, and the machine will either charge, or the sparks cease passing altogether. Shorten the spark-gap a trifle and repeat the maneuver. If this plan is tried over and over again, turning the Wimshurst very rapidly, starting the machine very slowly, and then increasing the speed, success will often reward the effort.

Failing in this, if the humidity is near eighty per cent. and there are no means for cooling the room and thereby condensing the moisture, there will be little use of continuing the effort, for under such conditions most of the current excited will pass away in the atmosphere, and no treatment prove effective. If, however, the fault is in the condition of the machine, and it is charged after much exertion, and the busy hours are at hand, do not let it once stop, nor close the conducting rods within one-half inch of each other until the last patient is treated, and then see that the machine is renovated.

If calcium is kept dry, or plenty of fresh lime is within the case during the heated season, such necessities will rarely arise except from the humidity. But that these precautions are not always taken, and that the knowledge is then valuable, is the excuse for devoting so much space to the subject.

The polarity of the machine changes from side to side while at rest or in taking a new charge without apparent cause. It is therefore necessary to have some manner of determining which is the positive or negative pole. The operator familiar with the work readily discerns the difference in the appearance of the discharge from the two poles when the discharging rods are separated just far enough that a spark will not pass—the fan-tail discharge from the negative radiating in straight lines from the ball, and the broken tree-like discharge from the positive. While charging, note the spark discharge between the balls—the bright dash will be on the positive side.

Two good ground connections are necessary, which we will designate as Nos. 1 and 2, to obtain the most potent effects when local connections, disruptive and convective discharges are employed. The water and gas pipe systems in city houses serve the purpose well. From rings or screw-eyes con-

veniently placed small wires may be run, one to the water pipe and the other to the gas pipe, or to two iron rods driven deep enough to be in constantly damp earth. To the rings or screw-eyes the chains will be conveniently connected during administrations. Always take care that the wires or chains conveying static electricity do not come in proximity to wires conveying the street current, or the fuses will be blown out, or possibly some wire or chain melted and the light and power cut out.

The forms of administration are varied in the methods of application and consist of sparks, also known as disruptive discharges; breeze, spray, and brush discharge, called also convective discharges; and currents or conductive discharges.

The oldest form of administration is sparks. Abbé Nollet in 1734 was the pioneer. Later Benjamin Franklin, John Wesley (the founder of Methodism), and others, are reported to have performed many cures by their use. Vigoreaux in Charcot's clinic brought the use of Franklinism into great prominence before the medical profession, and deserves the credit of its institution into more general medical use. Morton, a student of Charcot, brought the first influence machines to this country in 1881, and to his efforts and teachings the world is greatly indebted, both for a definite knowledge of a proper administration and correct electro-therapeutics.

The employment of sparks, painful and unpleasant as is the sensation, performs useful services which no other therapeutic measure can accomplish. In the administration of sparks, there is some diversity of opinion as to the effects of polarity. One patient will tell you that the negative spark is most painful, and another that the positive is. The facts are, there is little difference—both are painful and both are effective. The choice, however, is in favor of the positive spark—the spark of positive insulation, because a longer, cleaner spark is produced from that connection. The negative is more apt to split or divide, and does not seem to produce the same deep perturbatory effect. The spark of positive electrification is therefore the choice in all spark administrations. We therefore ground the negative pole of the machine, and connect the positive pole with the platform, in contact with the chain or

plate, or chain of the plate. Take care that the metal parts are about one foot removed from the feet of the patient, lest sparks not intended pass; producing an unfavorable impression upon the patient of the operator's neglect or inexperience. Be sure that the platform is removed two and one-half to three feet from the machine, and never near or beneath a chandelier or other metal conductor. Place the chair upon the platform so that the patient sits directly opposite the prime conductor of the positive pole (the side connected with the platform). There are two reasons for this precaution: (1) Should the patient accidentally touch the ball he will get no spark, and (2) he will draw off none of the current and thus diminish the effect when, under certain conditions, all may be required.

The patient seated upon the platform, and the operating chain having been connected at one end with ground No. 2, the one not connected with the negative pole of the machine, and the other with the screw-eye in the side of the handle of the ball electrode to be used, see that the prime conductors are widely separated. (Care should be taken that the machine is charged before the patient is admitted to the operating room.) Start the machine at a rate of speed commensurate with the length of the spark to be administered; speed will vary much with weather conditions. Before administering the first spark to the patient, test the length by a discharge from the positive prime conductor, which will be somewhat longer than the discharge from the patient. At the instant immediately preceding the application of the first spark, or following intervals of rest during the treatment, place the ball, or one foot, against the platform to draw off the surplus of charge, or the first spark will be unnecessarily severe.

There are several common methods of regulating the length of the sparks to be administered: (1) the speed of the revolving plates; (2) the proximity of the plate or chain upon the platform with the person of the patient; (3) placing the discharging rods at varying distances, according to the length of spark to be administered; (4) by the operator drawing off a part of the current by the proximity of his person or clothing—stand away when long sparks are desired, and draw near, or place one foot upon the platform, when the shorter sparks are preferred. The latter plan is valuable when giving a patient a general treatment by sparks, when it is desirable to apply long sparks to certain parts of the body and shorter ones to other regions. (5) When powerful effects are sought, the patient may take the chain or shepherd's crook in his hands (a very disagreeable method for the patient, because of the painful contraction of the muscles of the hands), or stand with the shoes removed upon the metal plate. This plan will also be valuable during periods of humidity, when the output of electricity to the patient is small.

When administering sparks, use a wrist movement instead of the arm movement, which is awkward and tiresome. First measure the length of sparks by a few experimental applications, observing the preceding rules for regulating their length. Knowing at what distance from the patient a spark will be discharged, move the ball to that point and immediately retreat before a second spark escapes. Repeated sparks to the same point are exceedingly painful and disagreeable. With a little patience, employing the wrist movement, the knack of administration is soon acquired. A swinging motion, allowing single sparks to escape, as the ball is passed to and fro, is another method useful in applications to convex surfaces. When treating anæsthetic areas, or patients who are tolerant from familiarity or hardihood, much time may be saved by rapidly passing the ball electrode parallel with the surface of the body at such a distance that rows of sparks will be discharged.

The application of sparks in hollows or angles is often difficult of performance, as in treating the throat or perineum. The small ball electrode meets the difficulty in treating the throat; or, by using a spark director of glass or hard rubber, represented in Figs. 3 and 4, the sparks may be easily localized.

The size of the ball electrode determines the fatness or width of the spark. Remember that sparks applied over bony prominences do no good and are exceedingly painful; also avoid

applying sparks to the breasts of the female and external genitals of the male, also to the nails of the fingers and toes. When administering sparks, breeze, spray, or brush discharge over wet clothing and certain fabrics (especially cotton), the effect is abortive. Over such garments place some good non-conducting material—a piece of woolen cloth or even a newspaper.

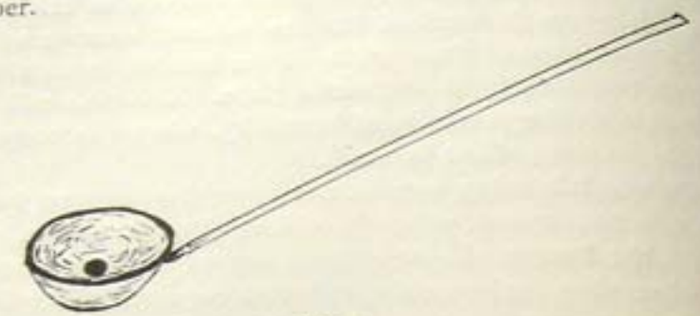


FIG. 3.

Sparks may be classified as (1) direct, (2) indirect, (3) friction, and (4) Leyden jar; and their peculiarities, indications, and mode of application described as follows:

I. *The indirect spark* is the form indicated in most instances where sparks should be administered. We will repeat here only the mode of making the connections. (1) By means of a

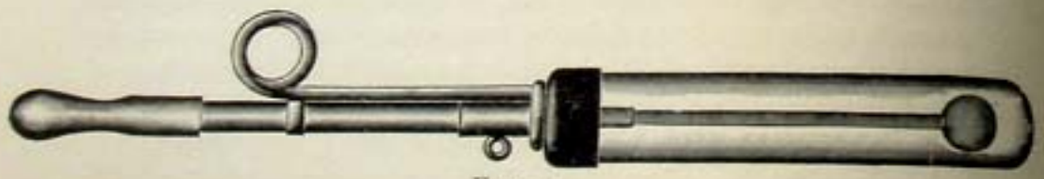


FIG. 4.

chain connect the negative pole with a direct metallic ground connection (ground No. 1). (2) Place the insulated platform two and one-half to three feet from the machine. (3) Connect the other side of the machine with the platform, using the shepherd's crook, rod, or chain; whichever is provided for the purpose. (4) Separate widely the discharging rods. (5) Connect the operating chain, having ball electrode attached to a

second good ground connection (ground No. 2). (6) The patient having seated himself upon the platform, start the machine.

II. *The direct method* is employed only during periods of humidity, when it is found impossible to use the indirect spark. This spark is much more painful and can rarely be administered in single sparks. During the administration, the operator's chain must be held with the chain holder in the left hand of the operator in such a manner that it does not come in contact with himself or the patient, while the sparks are administered with the ball electrode in the right hand. The mode of connection is as follows: (1) Place the platform and connect it with the positive pole of the machine by crook, etc., as in the preceding method. (2) Separate the discharging rods widely apart. (3) Connect a short operating chain to the negative side of the machine, and place the spiral chain holders at about the center of the chain. The patient seated, start the machine.

III. *The friction spark* is administered by rapidly passing a metal electrode over the clothing or hair, all connections being made identically as when administering the indirect spark (during periods of humidity the indirect method may be employed). The thickness of the material intervening between the surface of the body and the electrode determines the length of the sparks. The roller electrode was originally intended for use in this form of administration, but is not nearly so good nor convenient in our experience as the large ball electrode provided with a handle, having a long metal portion above the insertion of the insulated part. Applying the ball and handle in making the applications, it can be moved rapidly and efficiently over any surface of the body. If making a general application of friction sparks, pass the ball and metal portion of the handle very rapidly over the body by long strokes, and when treating small areas pause at short intervals, and the patient will submit to all the application the case demands. This form of application relieves pain, is highly stimulating to the peripheral circulation, acts as a counterirritant, and promotes secretion.

IV. *The Leyden-jar sparks* are too severe for administration, except in cases calling for some profound mental effect of discipline or suggestion. They would be administered by the same arrangement as the direct sparks; adding two Leyden jars having their outer coats connected by a device provided for the purpose, or a metal rod.

CHAPTER V.

THE CONVECTIVE FORMS OF ADMINISTRATION.

The forms of static application which are administered without direct metallic connection between the patient and machine (conductive discharges), or by spark discharges (disruptive discharges), are convective discharges. They are *static electrification, breeze, spray,* and *brush discharge.*

Static electrification, also known as the *static bath* and *static insulation,* usually administered in connection with a breeze or spray by placing the stand with point electrode near some portion of the body of the patient, is the simplest and least objectionable, and naturally the least potent, form of administration. (1) The point electrode when treating a case is connected with ground No. 2, as in giving sparks, and, if not to be interrupted, the chain or shepherd's crook may be held by the patient and otherwise placed upon the platform. (2) The other pole is grounded. The discharging rods are widely separated if treatment is to be constant, or placed at the desired distance apart if interrupted electrification is to be administered. In the event of using interrupted electrification take care, before starting the machine, that the metal plate, chain, or end of the shepherd's crook, one or all, are a few inches further from the feet or person of the patient than the length of spark-gap which is to be used; or that the patient is seated with his shoes removed, and feet upon the plate. Static electrification—interrupted electrification preferred, except in fidgety patients who are disturbed by the noise of the discharge (which may be much lessened by using a muffler)—is a less effective tonic form of application than the wave current

or sparks, but in certain cases is to be preferred, either exclusive of other forms of treatment or accessory to breeze, spray, or sparks, local or general.

The breeze or soufle is a mild form of application and is employed as an accessory to static electrification, constant or

FIG. 5.

interrupted, and the wave current. The stand electrode is called into requisition and may or may not be connected, according to indications, by the operating chain to ground No. 2. The point of the electrode—either bare or having the crown, or tassel, attached—is placed over the head of the patient, or the point alone near any other part to which it is desired to draw the bulk of the discharge. Another method is to connect the brush electrode with the operating chain, tak-

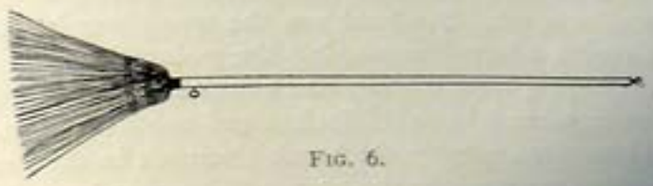


FIG. 6.

ing care that it is kept at the proper distance while moving it over and around the patient. Though not of special value therapeutically, the last maneuver often serves a good purpose when introducing a timid patient to static methods.

Another method of administering the breeze is by employing the static cage—the cage being suspended around the person of the patient and having direct connection with ground No. 2; at the same time the patient is seated or standing with the feet upon the metal plate. This form of treatment has also been administered combined with interrupted electrification, the spark-gap discharging at any desired length.

In this event the patient must stand upon the plate with shoes removed, or the passage of sparks through the heels and soles will be intolerable. The objections to this method are (1) the suspense of the patient lest he get a spark, (2) some portions of the person of the patient will be nearer the metal of the cage than others, and from such surfaces the current will nearly all escape, and the treatment intended to be general will become local without reference to the lesion. (3) The apparatus is cumbersome and expensive, and at the same time not so effective in its constitutional effects as the wave current (see Wave-Current Constitutional Treatment) which it simulates.

The spray is a warm or hot breeze, differing from the breeze in arrangement only in the nearer proximity of the electrode to the person of the patient. To produce the strongest effect of the spray, there must be some non-conducting material, except over the hair, between the surface of the body and the electrode. A thick woolen or silk garment produces the strongest effect. It will be found convenient to have a square yard of good material for use when treating the hands or face, or to throw over damp clothes or fabrics not adapted to the spray or spark. For local use, the spray may be directed to the region affected employing the point electrode or an electrode having many points, and allowed to pass for five or ten minutes, when it has a rubifacient and anodyne effect. For general treatment, employ the brush electrode in the hands of the operator; passing it at the proper distances about the person of the patient, taking care not to discharge accidental sparks. Administered in this manner, it acts as a mild peripheral stimulant, and is agreeable to the patient, producing a favorable impression. Unless persisted in for a long time, however, it is not nearly so effective as the disagreeable friction sparks, which may be applied rapidly and effectively.

In the study and management of many cases there are few static maneuvers that cannot be found of special value, in selected cases.

The brush discharge resembles the spray and is so considered by many writers, but differs in so many essential features that it is deemed best for purposes of future reference, and to avoid confusion, to consider it under a distinct nomenclature. The writer considers it the most valuable of the forms of convective discharge and third in value of all the forms of administration.

The patient is connected to the negative pole of the machine by taking the shepherd's crook or chain in the hands or placing the feet, with shoes removed, upon the metal plate, which is in contact with the shepherd's crook. (An accidental spark administered with the rod in the patient's hands is a painful and most disagreeable occurrence, while to the feet it is not of so much importance if the shoes are removed.) The object of direct contact is the necessity of a strong passage to insure efficiency to overcome the resistance of the electrode, which should be of wood, preferably of soft maple, which may become so dry as to require moistening, or a glass vacuum tube of the proper degree of rarefaction. During an administration the positive pole of the machine is grounded to ground No. 1, and the electrode connected with the chain to ground No. 2. Or, during periods of humidity, employ the direct connection, as in administration of the direct spark. Administration may be made direct to the skin of the patient, or through the clothing or other intervening material not itself a good conductor. Wet clothing and certain fabrics which are not of insulation materials offer the same obstacle as in the use of the spark or spray. While administering the brush discharge, the machine must be running at the speed required for the administration of long percussion sparks—consequently, great care must be taken that the operator's hands, the chain, or the connection of chain and electrode do not come too near the person of the patient, lest a spark may pass, much to the annoyance of both physician and patient. It is one of the most annoying and common accidents in the course of static administrations, and may be avoided only by constant thought and attention while treating the patient. It is best to connect the electrode at the end of the handle, taking the chain in the hand with the handle, moving it up or down, as desired, to increase or diminish the intensity of the discharge. If an administration is prolonged,

the handle will become sensibly hot, on account of the resistance due to the poor conductivity of the material.

The advantages of this form of application are as follows:

1. It is not disagreeable and may be administered to sensitive patients, and, though not as efficient as sparks in many cases, serves as a useful substitute until a timid patient will submit to them.

2. It is the best rubifacient form of treatment.

3. It is positively antiseptic, on account of the production of ozone at the surface of application.

4. It is better than the wave current for application to sprained or affected regions which are supplied with small muscles, as in the treatment of the hands or face, because the latter will cause painful muscular contractions if given with a long enough spark-gap to be effective. When it is desired to lessen hyperæmia, in the treatment of these cases, it must be continued for from ten to fifteen minutes to obtain the desired results.

5. The fact that it may be administered evenly to an affected surface, and is also rubifacient, makes it a most valuable accessory to all inflammatory cases demanding treatment by sparks.

6. As an application to the scalp, when patients object to sparks, and where the wave current cannot be employed, it surpasses the breeze or spray.

7. For application to surface affections, as superficial neuralgias, or diseases of the skin, it is invaluable.

CHAPTER VI.

CONDUCTIVE DISCHARGE.

Strictly speaking, all static discharges are currents, passing to and fro through the dielectric, or other media, as the chain or shepherd's crook, which may connect a patient or the platform with the machine. Such passages may be either insensible or associated with disruptive or convective discharges, but are not technically classified as currents, as are conductive discharges.

The *spark-gap* is the distinctive feature of a conductive discharge from the standpoint of the electro-therapeutist, and was first defined by Morton when referring to the static-induced current: "A regulated interruption in the otherwise inoperative circuit of a Holtz machine would produce in another part of the circuit a current adapted to electro-therapeutic practice."

In other words, the spark-gap discharge is essential to the production of physiological effect upon a patient placed in the circuit. This is easily demonstrated by placing the two hands upon the two prime conductors of a static machine, previously charged, and then starting it at a rapid rate of speed—the passage of the electricity is absolutely inoperative and inappreciable.

Two spark-gap currents having various modifications have been published, and are now generally used and understood by well-informed electro-therapeutists throughout the world. Both bear the name of Morton, who introduced them to the profession—the *static induced current* in 1881, and the *wave current* in 1899. Physicists may criticise the nomenclature, but the names are distinctive and for all practical purposes equally as good as the terms constant and interrupted referred to the older currents of Galvani and Faraday.

The *static induced current* first published in the Medical Record of March 26, 1881, and later, more fully and explicitly, in the Medical Record of January 24, 1891, antedated even at the later date all therapeutic consideration of currents of great frequency and high potential. For ten years it had been almost unrecognized except by advanced workers and, during that period, was the only published current possessed of such qualities.

The current was known abroad as "the current of Morton." Later the apparatus of d'Arsonval (Fig. 7) was introduced, and the consideration of the currents of "great frequency and high potential" came rapidly to be a new force in electro-therapeutics. The apparatus of d'Arsonval was the

result of an effort to produce, by transforming a street current, a current similar to the static induced current—a current safe of administration, of great frequency, and high potential. The

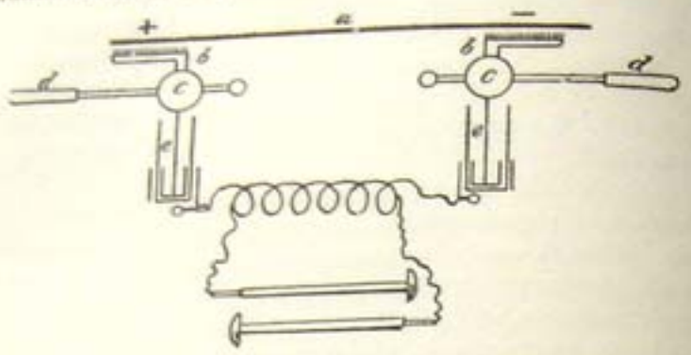


FIG. 7.—*a*, Revolving Plate; *b*, Collectors; *c*, Prime Conductors; *d*, Discharging Rods; *e*, Leyden Jars.

static induced current is represented in the accompanying drawing (Fig 8).

To operate the current, (1) place the two Leyden jars to be used in position, connecting the inner coating of the jars

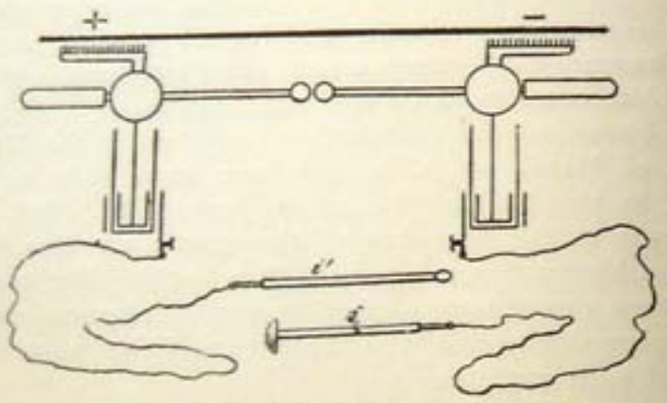


FIG. 8.

with the corresponding sides of the machine, (2) connect the rheophores with electrodes attached to binding posts provided on all static machines, (3) close the spark-gap of the machine, (4) place the patient (not insulated) and electrodes in position, (5) start the machine at a slow rate of speed and gradually open the spark-gap to the desired extent. If no transformer is employed within the circuit, use the very small Leyden jars, or the administration will be painfully severe. It is necessary to call into requisition some method of changing the character of the current if Leyden jars of larger size are used, such as are attached to most of the later patterns of Töpler-Holtz machines which are on the market. For this purpose an enlargement of the modified Criado water rheostat, adopted by Dr. Margaret Cleaves, is useful (see Fig. 9).

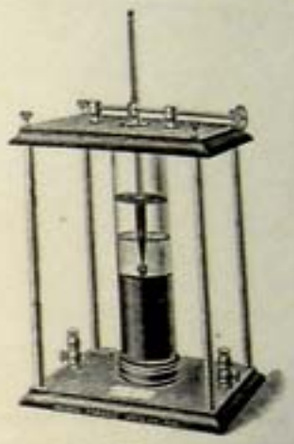


FIG. 9.

When placed within the circuit, employing the large jars or a long spark-gap, the current may be varied in amplitude or frequency and made most agreeable to the patient, without detracting from its other qualities. Various coils, employing either a primary alone or both a primary and secondary, will give shades of variation in the current, as with the various coils of Faradic apparatus, with the difference that in the first the source is of high potential, and the other of low potential.

By passing the static induced current first through a coarse primary coil over which is placed insulating material, and then wound with many turns of fine especially insulated wire,

—the Tesla transformer,—a current is induced of immense potential and very agreeable, either when administered as a current or applied as fine sparks from a vacuum tube or other electrode. This method of transforming the current was brought out by Professor Morton when experimenting with the Leyden jars in connection with X-ray work, and published in his work on that subject, and later described in his paper read before the American Electro-Therapeutic Association in September, 1900, as a "step-up" current (see Fig. 10).

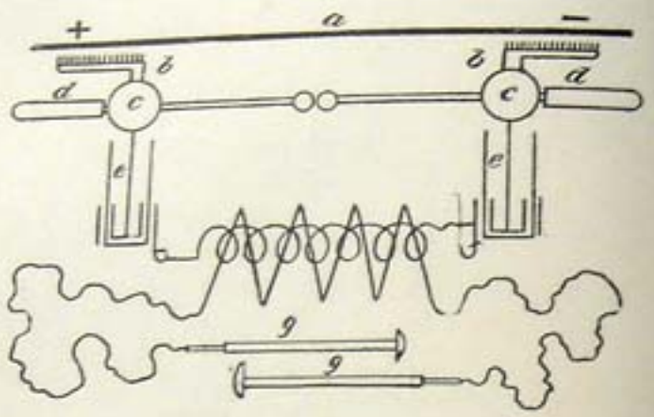


FIG. 10.—*a*, Revolving Plate; *b*, Collecting Combs; *c*, Prime Conductors; *d*, Discharging Rods; *e*, Leyden Jars; *g*, Electrode.

If currents passing between two poles are to be desired of *great* frequency, high potential, and small quantity, or of *small* frequency, high potential, and small quantity, there is no current with the aid of various Leyden jars and transformers more rich in the possibilities of variation than the static induced current.

Static currents are currents of *high potential* and *small quantity*, having the frequency of oscillation under the control of the operator. They are safer than the currents of the d'Arsonval apparatus and to be preferred, unless for some reason a greater amperage may be demonstrated of advantage. To

us this very action, not a characteristic of currents of small quantity, is the objectionable feature of the d'Arsonval currents, and places them in the same category with medicines which are designed and do benefit to one condition, but require most careful watching lest greater mischief than good result.

The static induced current, except when the conditions of the quantity enter as a factor, is the most adaptable of all *two-pole currents*. The term *two-pole current* is employed in a relative sense, and is used in contradistinction to the *wave current* in which but one electrode is employed, the dielectric, the air, except when saturated with moisture, bearing away but a small part of the electricity.

A one-pole current, as the wave current will be considered, is the current of charge and discharge—an oscillating current in which there is but one connection from the source, the patient receiving a positive or negative charge at the discretion of the operator. *Two-pole currents* pass between the electrodes, the major part by channels of least resistance, varying in the extent of tissue electrified with the ratio according to the amount of potential utilized. *One-pole currents*, surging from electrode to surface, electrize the whole body of the patient.

Static electricity, when at rest, surrounds the surface of bodies said to be charged.

To reach such surface in its surgings it takes the shortest route, as do all displacement currents. It passes through the relatively homogeneous moist tissues of the body, and not over the dry skin, which is a poor conductor (the relative conductivity being about as one to one hundred). From the surface of contact with the electrode, electricity radiates in every direction to the surface of the patient, and back, with each charge and subsequent discharge. To the activities excited in cell protoplasm, both the mechanical, as of a breeze passing through the leaves of the trees, and the electrical, whatever they may be, are undoubtedly due the remarkable nutritional effect of the *one-pole current*. But there is another physical effect of a conductive discharge received upon a

small area, without a means of exit by a continuance of the metallic circuit. It is as though a stream of water under high pressure had been suddenly thrown against a resisting surface. If a powerful stream is thrown against dry earth, how soon a depression appears and how soon the loam becomes saturated. So, if an electrical discharge of an immense potential is received upon a small resisting surface (the skin) of an insulated object (the body of the patient) placed in the path of the current, the impact at the surface of discharge will be marked, producing a local vibratory effect. The intensity of the effect will depend upon (1) the resistance of the skin, which diminishes as it becomes moist, (2) upon the size of the surface receiving the discharge, and (3) upon the potential of the current. So different, then, are the conditions and effects of currents having a receiving and discharging electrode, and those having but the receiving electrode, that there are reasons to expect different results. And different results are obtained, which are awakening new interest in electro-therapeutics.

The wave current (quoting from the paper of Dr. Morton read before the American Electro-Therapeutic Association, September 23, 1900) "was first so termed because its circuit to be completed produced Hertzian waves emanating from the patient's person."

The current was first published in the Bulletin Officiel de la Société Française d'Electrothérapie of January, 1899, and later in the Electrical Engineer of March 4 of the same year, and by the writer, in the Medical Record of March 3, 1900, and in the Transactions of the American Electro-Therapeutic Association for 1900.

The connections to produce are given here (Fig. 11).

"A very important modification of this method is shown in the next illustration (Fig. 12).

"A metallic foot-plate, upon which the patient's bare feet rest, is connected by a rheophore to an extraneous and independent insulated capacity. I generally employ for this attachment a zinc plate, two feet by five feet in size, supported upon insulated tripod legs. Any other metallic electrode, in

any other situation upon the patient's person, may be substituted for the metallic foot-plate." *

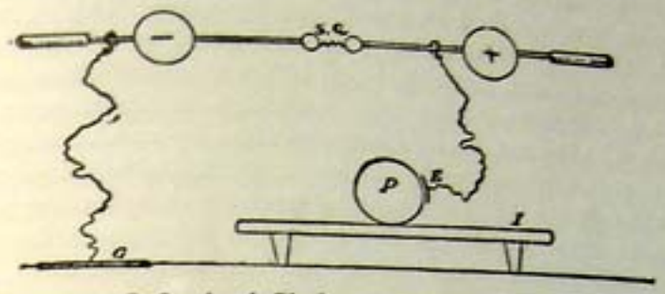


FIG. 11.—I, Insulated Platform; P, Patient; E, Electrode; G, General Connection; S G, Spark-Gap.

The Wave Current may be intensified and varied by employing an "external insulated capacity," as suggested above, and by making different connections employing a single Leyden

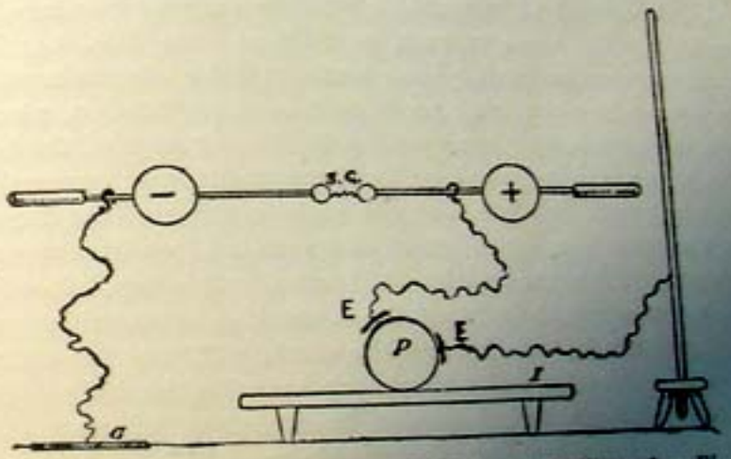


FIG. 12.—I, Insulated Platform; P, Patient; E, Electrode; E', Second Electrode; G, Ground Connection; S G, Spark-Gap.

jar, two electrodes, a device for a second spark-gap and a second ground connection.

* The above, including cuts, was taken, with Dr. Morton's consent, from the report of Transactions of the American Electro-Therapeutic Association for 1900.

I. When it is desired to intensify or localize the current by employing an "external insulated capacity" (see Fig. 13) it may be accomplished in the following ways: (1) A metal sheet is suspended upon an insulated stand or by insulation material, as a cord, from the point of the standard electrode, to which a rheophore passes from an electrode placed upon the patient, who has previously been connected by an electrode and rheophore to the machine by the usual method of administering the wave current. (2) By making use of a chair having glass castors or other insulation (as telegraph insulators) beneath the legs—the chair placed upon the insulated platform, the patient being seated on the chair with feet placed upon the metal plate which is placed upon the platform, the patient at the same time having the usual connections for application of the wave current. (3) Instead of the preceding a connection with either the inner or outer coating of a Leyden jar placed upon a table or the machine may be substituted.

II. A current of remarkable potency may be produced by modifying the wave current, as follows (see Fig. 14: The usual connections having been made, and the electrode placed upon a surface requiring an intense local application, place a second electrode or plate upon an indifferent part of the body or a part requiring a milder local treatment, and connect the latter electrode or plate with the inner coating of the Leyden jar, the outer coating of which is connected by direct metallic connection with the earth. A second spark-gap, placed in such a manner as to interrupt the connection between the outer coating of the Leyden jar and the earth, will vary the character of the current. The spark-gap between the balls of the discharging rods will, however, be employed to control the current strength, and the other spark-gap will be relatively of little value.

III. Another current very similar in character and effect to the static induced current may be produced with one Leyden jar, as follows (see Fig. 15): The discharging rods being widely separated, and one pole of the machine grounded, the other side is connected both with the patient and the inner coating of a Leyden jar. Another electrode placed upon the

Fig. 13.—Showing patient having large abdominal electrode connected with outer coating of the Leyden jar, and direct connection to an electrode placed upon the ankle.

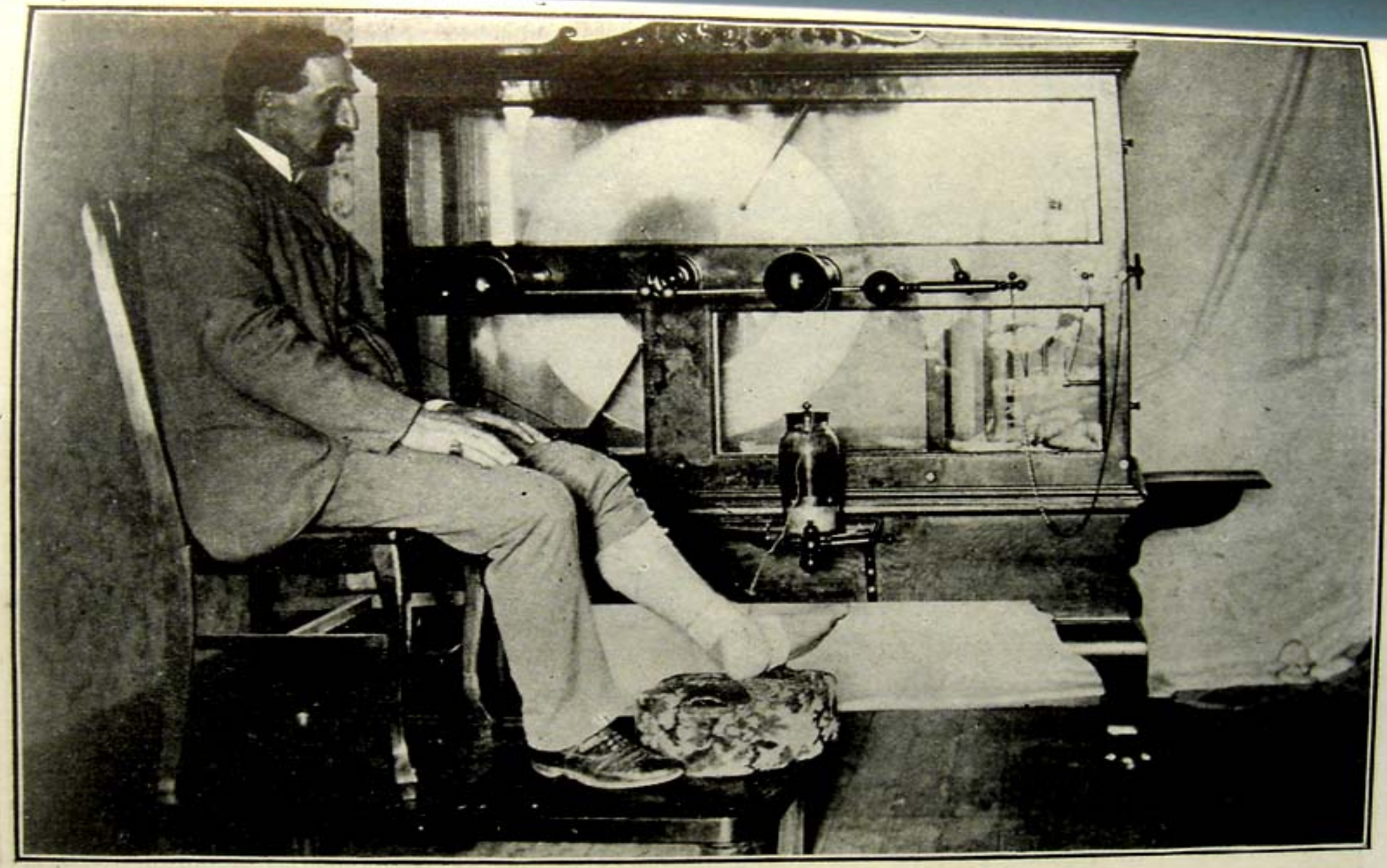


FIG. 13.—Showing patient having large abdominal electrode connected with outer coating of the Leyden jar and direct connection to an electrode placed upon the ankle.

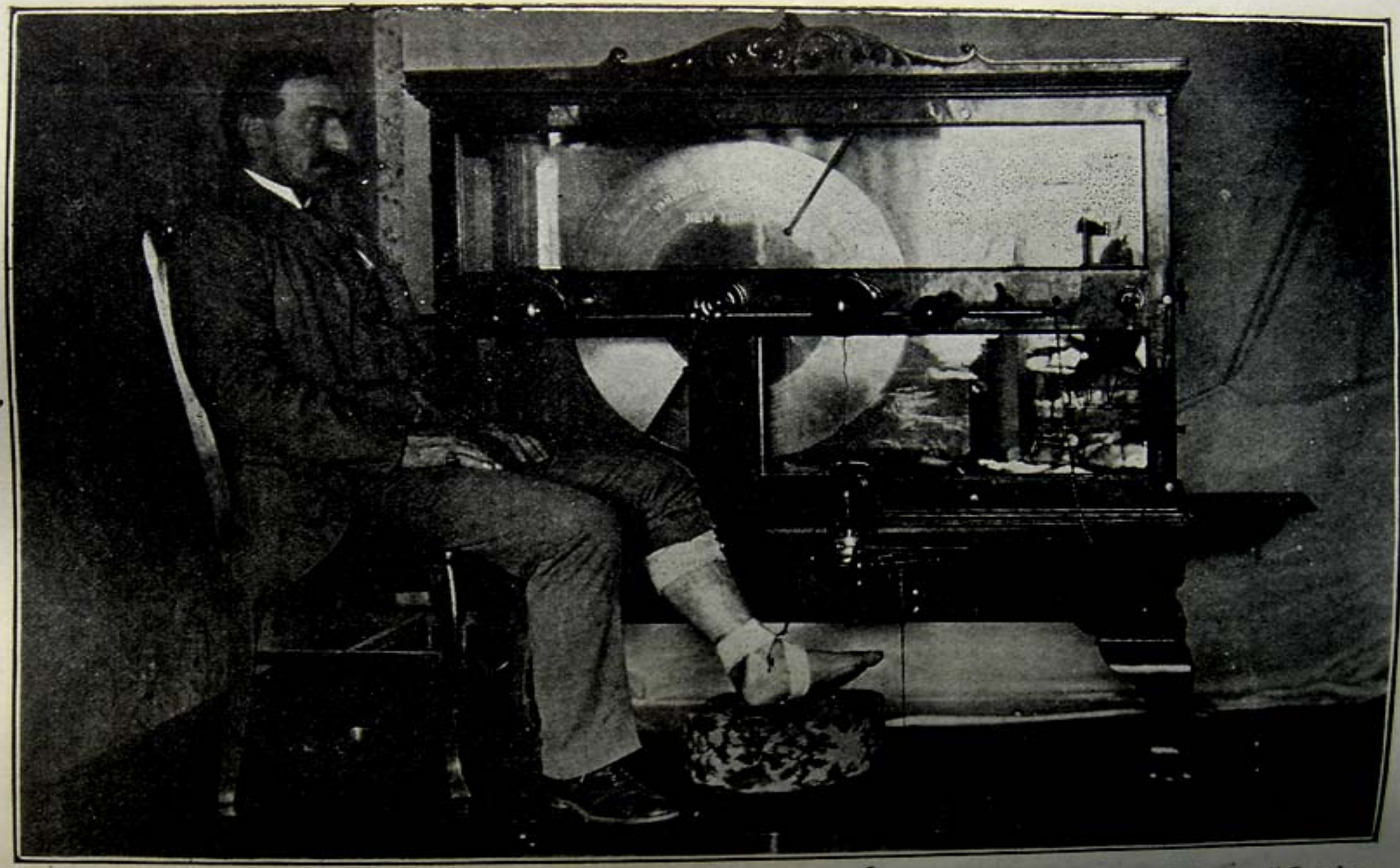


FIG. 14.—Showing patient with large electrode upon the abdomen, connected with inner coating of the small Leyden jar, having the outer coating grounded to ground No. 2, and a second connection direct from the machine to the electrode upon the ankle.

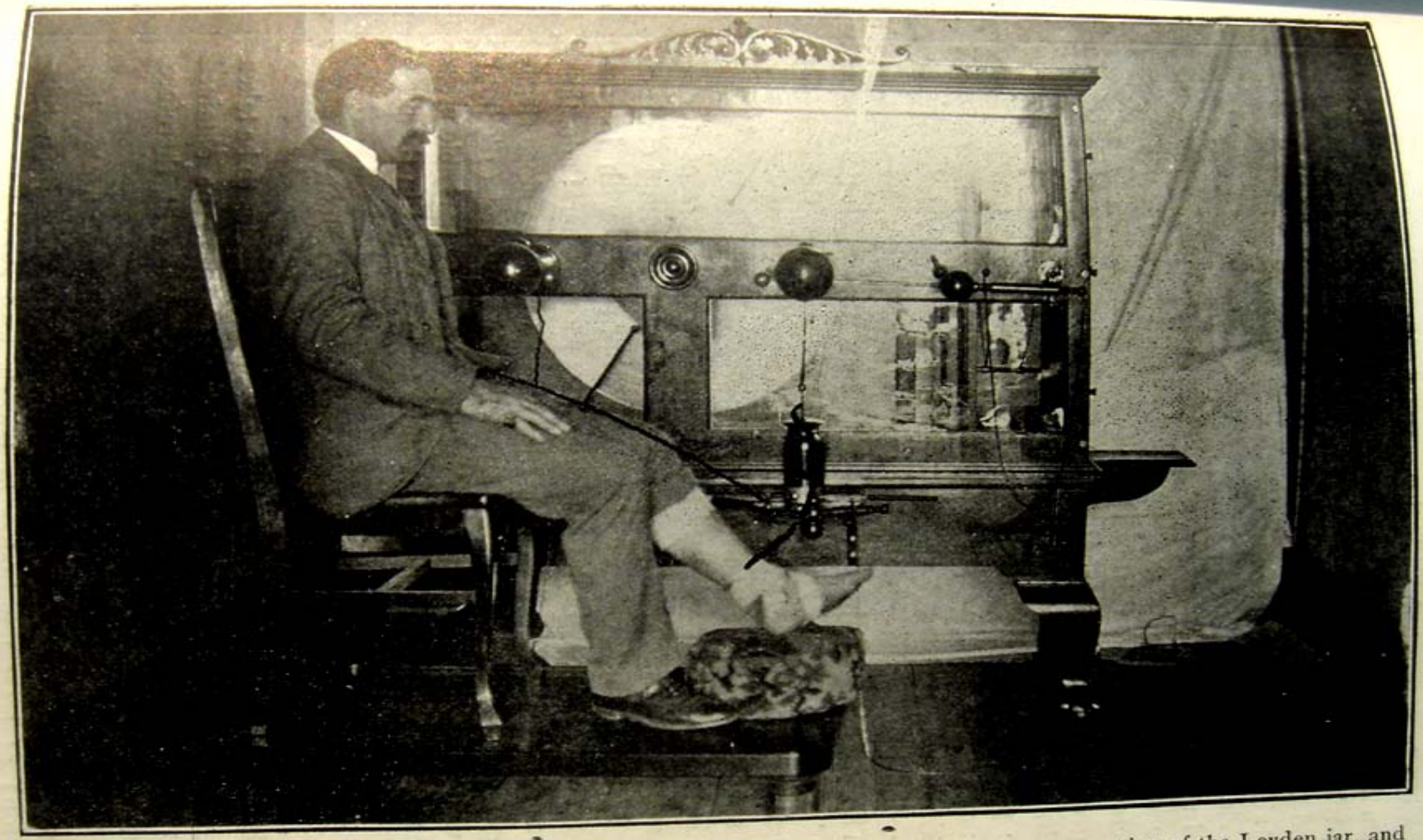


FIG. 15.—Showing the patient having connection from an abdominal electrode to the outer coating of the Leyden jar, and connection from the inner coating, which is also connected with one side of the machine; the spark-gap between small ball connected with the outer coating and another connected with the earth.

patient is connected with the outer coating of the same Leyden jar, and by a device so arranged as to give a regulated spark discharge between the outer coating of the Leyden jar and a direct earth connection, a current of marked intensity is established, of about equal strength at the surface of each electrode.

In currents I. and II. the intensity of effect is greater on the side connected with the machine than on the side connected with the "external capacity," or the Leyden jar having a ground connection from the outer coating.

In these modified currents, the administration is made with the patient insulated, and the effect is local to a marked, and constitutional to a very moderate, degree. Whereas the unmodified wave current is constitutional in a very large measure, and has relatively less, but generally sufficient, local effect.

The intensity of the currents may be varied with the size of the "external capacity, the size of the Leyden jar, the size and proximity of the electrode, or the length of the spark-gap, and the speed and capacity of the machine.

The writer became familiar with the wave current during the summer of 1898, while in charge of the office and clinic of Dr. Morton, and was so favorably impressed with its nutritional effects that he later induced its more general adoption. It was afterwards used in very many cases and has since steadily grown in favor. During the following winter (1898-99) the writer in his private office discovered two remarkable properties of the current, which have now been verified in the practice of many physicians.

I. The *lessening* of *hyperæmia* and *congestion* and

II. The *relief of local pain.*

There are many important factors and accessories to be taken into consideration, if satisfactory results are to be obtained from administration of the wave current. We will, therefore, devote considerable space to details.

I. The *insulated platform* should be provided with glass legs (glass has been demonstrated to furnish the most perfect insulation) at least ten inches in length, and should be placed at a sufficient distance from the machine and surrounding objects to prevent the escape of electricity.

II. *The rheophore* should be always taut to prevent possible leakage, and may or may not be insulated with rubber tubing, which is desirable if the current is to be conducted for a considerable distance.

III. *The electrodes.*—There are many points to be taken into consideration concerning electrodes and their application.

1. The electrode must be in close contact with the surface treated. Intervening material—as clothing, a cord, a scab, or loose scales of epidermis—will cause an intolerable burning sensation, from the passage of innumerable short sparks to the surface. The dry skin requires, in a less legree, consideration. This is especially true of "the exposed portions of the neck," which may be moistened, or by starting the administration with a short spark-gap, and after a few minutes, as the skin becomes moist, separate the balls of the discharging rods to the distance indicated. It is well that all electrodes applied be either secured with bandages, the hand of the patient, or by placing a pillow where pressure will hold it in close apposition. We always place a pillow at the back when using the long spinal electrode, and also prefer having a chair with a high back, as it is often desirable to place an electrode upon the neck.

2. The size of the electrode is a matter of importance and will be governed by the capacity of the machine at the time of the administration, and the effect sought. During periods of humidity, or when, from neglect, the capacity of the machine is lowered, it will be found necessary to concentrate the energies of the current; the electrode used then must be relatively small. It is possible to make only general rules to govern the size of electrodes, which must depend upon the part treated, the patient, and the lesion. When applied to the muscles of the thigh, leg, or trunk of an adult, an electrode should not exceed twenty-four square inches in size for a spark-gap of four or five inches, and may often be advantageously used with the same spark-gap, when of not more than eight square inches. Muscular contraction or pain over an inflamed area will determine the relative size of the electrode to the spark-gap.

3. *Special electrodes* for treating the mucous surfaces of the open cavities are required; or various metal sounds, specula, etc., may be utilized in many cases. (These will be considered in chapters on special therapeutics.)

4. *The material of electrodes* must be of some good conducting substance, preferably of metal. Sheets of block tin of suitable thickness may be easily cut with a pair of scissors into any desired shape and molded to the surface, or lead will answer as well. We employ two thicknesses—22-gauge for the long spinal electrodes, because it has sufficient rigidity to permit it to be pushed beneath the clothing; and 32-gauge for application to uncovered surfaces. The thicker will often be preferred when considerable pressure is to be exerted over soft structures. Tinsel or tinsel braid, such as is used for trimming (preferably the cheap article used by stage costumers), serves an excellent purpose and may be applied as a bandage.

IV. *A good ground* to the pole not connected with the patient is imperative if any but the mildest effect is sought, as may be the case when treating the eye, ear, nose, or throat, when, if not connected with the ground chain, it may be made less severe and graduated without becoming too intense to be borne.

V. *The polarity* of the current has not been demonstrated to especially affect the results of administration, but it is noticeable that, under the same conditions and with the same length of spark-gap, there are about twice the number of oscillations from the positive side, the negative being grounded, than from the negative. The maximum spark-gap, when the negative is grounded, is also slightly longer than when the positive is grounded, other conditions being the same. The spark discharged is more clean cut, brighter, and the percuscussion sound more marked when the positive is grounded. These observations would seem to mark the negative current as the choice when local vibratory effects are indicated, and the positive for constitutional effects when frequency with greatest potential and amplitude of vibration are desired.

VI. *The length of the spark-gap* (the distance between the balls of the discharging rods) measures the resistance to be overcome by each discharge, and consequently the pressure, or electro-motive force, exerted upon the patient placed upon the insulated platform.

The possible maximum spark-length at the time of administration will depend upon (1) the capacity of the machine, which will depend upon its condition and the diameter of the revolving plates; (2) the condition of the atmosphere; (3) the speed of the machine; (4) the character of the insulation (see insulated platform); (5) the proximity of surrounding objects; (6) the physical characteristics and clothing of the patient (size and presence of many points, as hairs, allowing a greater escape of electricity to the dielectric).

VII. *The patient* before administration, if a lady, should remove her hat, and it is best always for patients who are taking electro-static treatment to use bone or rubber (not metal) hair pins, as the metal ones may cause disagreeable sensations and greatly annoy timid patients. Rubbers should also be removed before the machine is started. It is always well to advise patients to remove their watches, for, though rarely, they are certainly sometimes affected by the currents.

The patient should be placed in a comfortable position, if the treatment is to be long, and great care taken that the spark-gap is gradually opened after starting the machine at the beginning of the treatment; or, what is more important to observe, because it is more likely to occur, is that if for any reason, the machine is stopped during the administration and again started, or the speed accelerated, the passage of single or infrequent long sparks at the spark-gap does not occur, because they produce very unpleasant sensations of shock. Consult the patient's comfort always and employ no administration producing painful muscular contractions or severe pain, when treating inflammatory areas. If the noise of the discharging spark annoys the patient, which it rarely does, make use of the muffler.

VIII. The advantages of the derived currents consist in (1) their pronounced local effects, requiring as they do relatively small capacity in the machine, a short spark-gap, and slow

speed, making them especially valuable to those having inferior machines; (2) to all during periods of humidity; (3) to those depending upon hand power for exciting their currents; (4) in all cases where very large areas require the application of powerful currents, and (5) when it is desirable to localize the effects between two electrodes. The effects are so similar in their local effects, especially with the two former, that the choice exists chiefly in the matter of convenience, which seems to be in favor of the second. Electrodes may be employed in connection with one or more joints requiring the same degree of effect connected in series, and the other large electrode placed upon the back or abdomen, or some part requiring a more or less potent effect, as the case may be; or the electrodes may be placed upon opposite sides of a region of the body requiring treatment (care being taken that they do not come in contact), for the purpose of localizing the effect within the intervening structures. Thus the very potent electrode connected directly with the machine, or the milder electrode connected with the Leyden jar, may be utilized according to the indications of the case.

Time will determine the relative value of the various static currents, but we believe that, except for the advantages indicated, the unmodified wave current described in this chapter must be preferred; for its remarkable effects upon the general nutrition are due, not alone to intensity, but to the great amplitude and vigor of the administrations.

CHAPTER VII.

PHYSIOLOGICAL ACTIONS.

The literature of the actions of static electricity, except as derived from therapeutic applications to diseased conditions, is very meager indeed. In fact, so slight are the effects upon the normal individual that a study with such affords small chance to make the deductions necessary to form a basis for therapeutic indications. It is, therefore, necessary to observe the effects under the different conditions, and therefrom draw

conclusions. The writer will treat the subject from the two standpoints. Franklinism has in it little, or we believe absolutely no, element of danger to be taken into account, and is, therefore, the choice of all electric forms of administration to be put in the hands of the novice, for he cannot do injury to the patient and, if fairly cautious, as he is bound to be, may do some good.

Many to-day consider the static modalities as but "suggestive therapeutic placeboes," which they are, in cases amenable to such influences, but their safety does not preclude the possibility of potency; as is demonstrated from exceptional results obtained in the treatment of conditions not so effectively relieved by any other measure, such as rheumatoid arthritis, sprains, and the forms of neuritis.

Compared with the constant (galvanic) current, the chemical action and transition of *ions* is insignificant, with the static modes of application. Electrolysis, cataphoresis, and cauterization—valuable measures as they are, where indicated—are practically impossible to obtain with Franklinism.

Experience seems to have also taught that currents having relatively large amperage to voltage are neither so safe nor effective for either local or constitutional use as currents of high voltage and very small amperage.

Faradic interrupted currents are relatively impotent, and the currents of the apparatus of d'Arsonval, and other transformed street currents, have in them the element of danger due to amperage. The oscillatory, interrupted, and vibratory influences of currents of *small quantity, great frequency, and high potential*, which are administered to the patient while insulated and in a state of so-called charge, are peculiar to the Franklinic forms of administration, and the effects differ, from this fact. The effects upon metabolism of vibratory influences have long been recognized by physiologists, such as are attributed to the heart's impulse. Dubois-Reymond taught "that the nutritional effects depend not on the quantity of the electricity, but upon the variations in the quantity, and the suddenness of these variations," which is true, but calls for qualification in the matter of quantity and other features of administration.

We would qualify them by saying that the degree of nutritional effects of electricity depends upon the following conditions:

I. The current must be possessed of the maximum power of diffusion consistent with safety, which quality is peculiar to currents of large voltage and small quantity.

II. That its effect upon organic structures must be to induce functional activity, without a possibility of altering the natural characteristics of the organs.

III. That the suddenness of the variations, from a state of charge to one of discharge, must be instant, frequent, and rhythmical, and administered to the patient while insulated.

IV. That administrations shall be regulated in frequency, dosage, and duration to the demands of individual conditions.

We believe that it can be truly said that the only modalities that can produce such pronounced effects are those administered with the patient insulated. No form of application employing an electric circuit between two poles, labile or stabile, can produce the degree of constitutional effect of a high-potential current of charge having interruptions of alternating discharge.

There are two characteristic effects for consideration—the *local* and the *constitutional*, which vary with different forms of administration.

The local effects of the *wave* current are most valuable and, enumerated collectively, are: (1) local sense of vibration in structures beneath the electrode and of the hairs upon the head and surface of the body; (2) muscular contraction, most marked when an electrode is applied over a motor point; (3) physiological tetanus, induced by powerful currents or over sensitive regions, as of the hands or arms, increased by lengthening the spark-gap, or accelerating the speed of the machine; (4) secretion of sweat, always marked beneath the electrode.

In addition are valuable clinical effects: (1) local congestion is relieved, often with marked diminution of swelling and pain; (2) relief of local pain, or tenderness from many causes, is marked; (3) relaxation of acute muscular spasm, not of central

origin; (4) increased local metabolism and repair if conditions are sluggish.

Sparks are in many conditions superior to the preceding, but in the aggregate cannot be considered as equal. The effects are: (1) a stinging sensation, accompanied by muscular contractions with the spark discharge; (2) at the point of discharge a blanched spot appears, due to contraction of capillary walls, which is followed, in a short time, by marked redness, which soon disappears, except in persons having weakened reaction; in these it may persist for twenty-four hours; (3) wheals, or even blisters, may be produced when sparks are administered successively; (4) sparks, like the wave current, increase local secretion and metabolic exchanges. Clinically, sparks also: (1) relax muscular spasm; (2) sedate pain; and (3) lessen hyperæmia and congestion. As a diaphoretic, and applied to muscular spasm and rigidity, as well as in its general massage effects, sparks excel very other modality.

The brush discharge, like the two preceding, though to a less degree, (1) increases secretion and activity of the end organs; (2) it is rubefacient and (3) antiseptic; and, clinically, (4) sedates pain, (5) lessens hyperæmia and congestion. The sensation produced is as if hot sand were thrown with considerable force against the parts.

The breeze and spray, which differ only in degree, produce a cool or warm sensation to the surface, varying with the proximity and the character of any material which may intervene. Non-conducting materials such as paper, woolen cloth, or silk increase the intensity of the convective discharges. The effects are the same as of the brush discharge, but less marked; varying with the proximity, etc.

The local effects of the static induced current are: (1) To produce muscular contraction or physiological tetanus; (2) to diminish local congestion and pain, in which it is much less effective than the other modes of administration. When, however, transformed by employing a Tesla coil, the applications with a connection from one pole,—employing as an electrode a modified Geissler's tube, or a glass electrode having an inner coating of metal, as suggested by Dr. Piffard,—produce an

effect similar in many respects to the brush discharge: (1) Rubefacient: (2) antiseptic; (3) vesicant; (4) lessening local pain and congestion. Sparks administered with the ordinary ball electrode are relatively painless, and effective for superficial applications. These administrations may be made without insulating the patient.

Clinically, there are two results derived from the *local effects* of these high-potential electric modalities which cannot fail to awaken an interest in the subject from every special department of medicine. They are the effects upon *hyperæmia* and *congestion*, and upon *pain*. Hyperæmia, passive, as found present in surgical œdema, is relieved with remarkable promptness, leaving the parts, within a short period, in a healthy condition. Active hyperæmia and congestion can be demonstrated in so many instances to be relieved that it may truly be said that in cases of hyperæmia or congestion not characterized by bone necrosis or the presence of specific processes, such as induce syphilis, gonorrhea, or tuberculosis, or from a foreign body in the tissues, will be lessened, relieved, and cured when Franklinism is properly applied for a period of time, generally depending upon the chronicity of the affection. Contusions, sprains, synovitis, cellulitis, and the forms of neuritis afford excellent examples of its efficiency. The modalities effective in such conditions are the wave current, brush discharge, sparks, breeze, and spray, and are in degree efficient in the order named. The causes to which such effects may be attributed are: (1) The tonic local contraction of cell protoplasm, especially of the muscular structures; (2) increased activity of the processes of repair and elimination, and (3) a coexisting systemic lowering of arterial tension, which prevents prompt return of blood to the affected regions.

Pain is relieved to a remarkable degree by the applications of Franklinism. Those which are present under conditions of pressure due to congestion disappear coincidently with the latter. The pains of tabes, neuralgia, and migraine are so generally relieved by the various modalities, that the action appears almost as a specific, from most causes. Of all the forms of applications the wave current may be considered superior in most painful conditions, and the others in the same order of preference as in the treatment of hyperæmia and congestion.

The local effects of static electricity in relieving pain and congestion would alone place it in first rank as a therapeutic measure.

The constitutional effects observed, when static electricity is administered to an individual in health, are practically *nil*. To those, however, in which there is a departure from the standard of health, from either functional or organic derangement, the effects are most pronounced.

I. *The effects upon the circulatory apparatus* are: (1) general lowering of arterial tension; (2) lessening of the frequency of the heart's action, with (3) lengthening of diastole and (4) increased volume of the pulse.

II. *Respiration* (1) becomes less labored and less frequent; (2) deepens, and (3) there is found at the same time to be an increased elimination of CO_2.

III. There will be a general relaxation and lessened nervous irritability if the opposite conditions be present.

IV. Patients invariably become drowsy, and often fall asleep during the administrations, sparks excepted. Especially is this true of the wave current or interrupted insulation.

V. Prolonged administrations produce in some patients a feeling of lassitude not comparable to fatigue.

VI. A general diaphoresis is induced in most patients, if sittings are from ten to twenty minutes, with the wave current, interrupted insulation, or the convective discharges. No therapeutic measure, we believe, will induce a general diaphoresis so promptly and without depression as a thorough application of sparks, long and friction.

VII. Inactive secretions and excretions are more or less induced to activity during a course of either local or constitutional administrations. So remarkable are these effects that patients receiving prolonged treatment for a local trouble invariably show marked general resumption of functional activity to organs not impaired by organic derangement. Especially marked is the aggregate increased elimination of solids with

the urine in rheumatic and gouty patients and those afflicted with rheumatoid arthritis.

VIII. There are reliable evidences of increased activity in the end organs of tissue metabolism, when a series of administrations are taken. (1) The increased oxidation evidenced by the marked additional elimination of CO_2; (2) the augmenting of the quantity of solids in the urine, with ultimate restoration of the proper proportions of normal constituents; (3) the restored appetite and steady increase in body-weight, until the patient's normal standard is reached, are the invariable results, if derangements are but functional.

IX. The constitutional effects of the "two-pole" static induced current are insignificant; in fact, the writer knows no indications to which the other modalities are not better adapted.

To summarize in a few words—*induced normal activity* defines the physiological effects of Franklinism, properly applied.

CHAPTER VIII.

GENERAL PRINCIPLES OF ELECTRO-STATIC ADMINISTRATION AND THERAPEUTICS.

The administrations of Franklinism are governed by general principles which, when once understood, constitute a basis for correct and successful operation.

The subjects for general consideration are the patient, the dosage, and the frequency of treatment.

I. *The patient*, who comes for the first static treatment in this age when criminals are electrocuted, citizens killed by live wires, and buildings burned through effects of poor insulation, is usually in a state of trepidation, and the numbers who do not come, for the same reason, are legion. Humbugs, quacks, and charlatans have made it a byword and subject of jest with the specialist and family physician, who may know little about its use; and, therefore, the patient's mind is terrorized, prejudiced, and skeptical before we see him. The first step, then, is to enlighten and calm his fears at the first

interview, which may be accomplished in all but a few cases, but requires (1) an explanation of the absence of danger from currents of high potential and *infinitesimal* quantity, and (2) the administration of the treatment without blunder or accident, thereby winning confidence, and (3) the management of the treatment in such a manner that some degree of benefit is derived from the first application.

To convince himself that the maximum output of the machine could not kill a patient, the writer once made the following experiment: A little mouse was captured and placed in a paper box having one side of glass. A small hole was made in one end, and the box was then set upon a metal plate, which had been already placed upon the insulated platform. The shepherd's crook was then connected from the plate to the machine, and the machine set in very rapid motion. Upwards of forty very long indirect sparks were then administered to the body and head of the little animal, and still he survived. That cruel experiment has served as a convincing argument to many timid patients and fully reassured the writer of the absence of all danger.

If the patient's affection is such that vigorous sparks are necessary to relieve the suffering at the first treatment, explain that it will be painful and then proceed. The writer recalls cases of podalgia, chronic rheumatism, etc., where nothing else would have given relief. As a rule such heroic measures are not necessary to give marked relief, though they may be required later in such cases. The patient's first few treatments may then be relatively mild. Generally, however, it is not safe practice to fail to make a favorable impression by giving some marked evidence of benefits in the early days of treatment, and it is rarely difficult to do so in cases to which the treatment is adapted; in fact, the first few treatments are often marked by such a degree of improvement that patients are impatient when it takes considerable time to effect a complete cure. Accidental sparks, shocks, and surprises generally are inexcusable, and, though they do happen with experienced operators, are certain to lessen the patient's confidence and awaken fears and doubts which subsequent arguments and explanations may not satisfy.

The idiosyncrasy of the patient, except from the effects of experience with other currents or the notions of prejudice or fear arising from other sources, is not nearly so often a factor to be considered, when administering static electricity, as laymen and physicians unfamiliar with its effects suppose. This is especially true of all forms of administration except the sparks when employed (as they should be) without accidents, because there are no shocks, unpleasant sensations, or physiological effects to disturb the patient's equilibrium. Apprehension of impending danger is the only element in impressionable patients with which the operator has to contend, and this will depend largely upon whether the patient has confidence in his attendant. Under such conditions, and possibly in a few others, instead of the usual glow which accompanies the administration, there may occur a condition, which has been described by others, in which "the patient remains chilly, depressed, and apprehensive." In most of these patients the effect is said to disappear after a few treatments. As the writer has never noted such effects, he can only quote the experience of those who have.

It is not unusual, with patients in whom the secretions are inactive, especially true of neurasthenics, that during the first few administrations they do not perspire.

The skin of some patients is especially susceptible to the convective and disruptive discharges; an unpleasant pruritus may persist for several days following an application. Wheals and even blisters have followed an application of the spray or sparks. With patients in whom the circulation is not good, and the reactions sluggish, a treatment by sparks may be followed by a mottled appearance, which may persist for twenty-four hours or even longer. Such effects disappear as the general health of the patient is restored.

When the dosage and form of administration are once regulated to the physical and local conditions of the patient, and the harmless character of the application fully explained, the number to whom the currents cannot be administered will be small indeed.

II. *The dosage,* the amount of current or other form of administration to be employed, and the length of time or number of sparks, can be regulated only by clinical experience and the study of individual requirements. To obtain a positive impression, generally, for either local or constitutional effects requires a minimum, we believe, of ten minutes' time with the wave current or either form of electrification or the convective discharges; and to obtain the best results often demands as many as thirty minutes, which may be considered a maximum requirement. An over-dose or too prolonged treatment may be followed by a sense of weariness and sleepy condition, never dangerous and always relieved by rest. When employing sparks, be governed in acute painful conditions by the relief afforded. If at first the improvement is but partial, and the patient does not object, persist until relief is complete, or at least nearly so; taking care to give no careless or unnecessary sparks, but applying them directly to the lesion, where they are certain to be the most painful. The patient soon discovers that sparks so applied are followed by the greater relief, and enters into the spirit of the treatment and directs the application to such points.

From time to time, in each case, be governed by the results of previous administrations, and learn to regulate the dosage to the individual, as in all other methods of medical practice. We believe, however, that in no other form of practice is the patient's *say so* in the matter of dosage more to be considered.

III. *The frequency of administrations* is a matter of the greatest importance, and we are convinced that the oft-repeated remarks of those who have carelessly employed static sparks, that "the relief is only temporary and does not cure," are due to want of thoroughness and failure to again administer the treatment before the relapse has been complete. The treatments should be repeated as soon as a commencing relapse is evident. *Bridging* is the term the writer has employed to express the repetition of treatments to prevent at most but partial relapse to the condition relieved. Whether we are treating a painful or inflammatory condition, or a case calling for a tonic effect, *the golden rule is to bridge the condition of relief from treatment to treatment, lessening*

the frequency as the requirements permit. Rarely will this rule call for more than one treatment in twenty-four hours. Occasionally, however, in acute inflammatory conditions, two treatments daily may be required for a few days. When employing Franklinism to obtain the nutritional effects, best results are derived from daily administrations for the first two to four weeks, to be determined by the progress of the case.

The knowledge of the physiological actions and effects of the different forms of administration suggest to the physician a large range of therapeutic indication, and in a general way the choice of modalities. There are, however, definite methods which experience has demonstrated will produce the best results. A classification is adopted in these chapters which groups the conditions with reference to types having similar indications for treatment, without reference to the ordinary classifications in text-books. This is done for the purpose of impressing upon those unfamiliar with the methods indications in many affections which the limited scope of this work will not permit.

It is hoped that, by particularizing in a number of cases which demonstrate the various effects, applications to special work will suggest themselves to the reader.

Only the conditions in which success has been achieved, in groups of cases, by the writer and others, will be considered. With such it is the purpose to be explicit and exact, trusting that good results in their hands will verify the truth of the statements.

We ask the indulgence of such as are unfamiliar with the subject; that they defer judgment until such time as there may be an opportunity to prove the truth of the statements. For there is wonderful progress in the uses of electricity in every field, and in medicine progress keeps pace.

So numerous are the diseased conditions associated with *hyperæmia* and *congestion*, and so certain are the demonstrations that they are relieved in a large number of cases where no other means are so effective, that it is more difficult to discriminate in what cases it is not indicated than to discover indications for its use.

In *paralysis* and *spasmodic conditions*, not of central origin, success is certain in all recent cases, and beneficial in most chronic ones. The same is true in peripheral *painful neuroses*, atrophies, anæsthesias, and functional disorders in general.

When *errors of secretion* or *excretion* exist, the prognosis will depend upon the condition of the organ in question. If the derangement is but functional, the prognosis will be good in most cases. Presumptuous as these statements will seem to many, let it be borne in mind that static electricity, scientifically applied to the human organism, is the *sine qua non* for activity, not of one cell but of all, not of one organ, but of all organs.

Equilibrium, to be restored, requires only properly regulated frequency and dosage, together with proper adaptation of food, habit, and environment. Functional derangements are cured and patients recovering from protracted fevers have their convalescence materially hastened.

CHAPTER IX.

ELECTRO-THERAPEUTICS OF INFLAMMATORY CONDITIONS.

Few pathological conditions are not characterized, to a greater or less degree, by congestive or passive hyperæmia. Irritants enter the economy, either as such, or from defective actions within the organism become irritants and induce local congestion. Accidents occasion traumatic congestions, which have received little attention from the electrotherapeutist. In no class of cases to-day is static electricity more successful, or other means—as a rule—so unsuccessful, as in hyperæmias and congestions.

For convenience of classification, we will divide the inflammatory conditions into (1) those characterized by the presence of micro-organisms, either demonstrated or suspected; (2) those due to bone necrosis; (3) traumatic affections, with and without solutions of continuity; (4) those arising from some dyscrasia, cachexia, or diathesis; and (5) those arising from functional inactivity and unknown causes.

I. The static forms of administration have little effect upon germ life, as upon other forms of cell protoplasm, except possibly upon those with which large productions of ozone may be brought in contact, and destroy their vitality by oxidation. Such administrations are applied with difficulty and uncertainty to all but superficial lesions, which will be treated in a chapter devoted to diseases of the skin. In tuberculosis we believe that the bacillus is not destroyed, except superficially, by any direct effect of the static modalities upon the germs, either by cataphoresis or ozone within the tissue, as some would teach us or we ourselves hope to demonstrate. We take this position because it seems to be physically impossible. Ozone inhalations are generally irritating when administered in sufficient quantities to be effective, but some report success from special devices which get rid of irritating properties.

That the penetrating effects of rays of light, especially the rays emanating from an excited Crookes tube, are effective in destroying tubercle bacilli and other forms of micro-organism, especially the suspected germs of carcinoma, is an open and interesting field of investigation, in which results already obtained promise much. (See chapter on "Therapeutics of the Roentgen Ray.")

That static tonic administrations do assist in curing incipient forms of phthisis by restoring the general health of the patient, thereby removing the lowered conditions essential to the growth of the bacillus, is an unquestionable fact.

II. In inflammatory conditions occurring with bone necrosis, where nature is attempting to remove the dead fragment, no measure but the surgeon's can be effective.

III. *Sprains and bruises*, not complicated by fracture, severance of ligaments from their insertions, muscular rupture or laceration of the integument, severe though they may be, yield more promptly and completely to electric treatment than to any other. The wave current, the brush discharge, and sparks are the modalities effective. The wave current should be administered to the surface or joint by placing the metal electrode in close contact with the part affected, and then regulate the length of the spark-gap to the case—employing

it always as long as it can be used without producing painful contractions of the muscle. Continue this treatment for from ten to twenty minutes, bearing in mind that the longer time is sure to be effective, while often less would not suffice. In many cases the wave current will be all that is required, in others the administration of the brush discharge, employing the wooden ball electrode, will still further remove superficial tenderness or swelling. Many cases, especially about the face or hands, where the tissues are not dense and deep, and the small muscles are so sensitive to the wave current, can be completely relieved with ten to twenty minutes' application of the brush discharge, the time depending upon the severity of the case and the extent of the area affected. When applying the brush discharge it must be constantly moved about, or it will otherwise be quite intolerable.

When the deep structures of large joints are involved, or in very stout patients, it will often be necessary to employ longer or shorter sparks directly to the affected region. The indication for the application of sparks will be the persistence of pain on motion, felt deep in the structures of the joint after treatment.

The results from these methods are uniformly good. The pain and swelling will be much diminished at the time of administration, and cases of not more than twenty-four hours' standing will be uniformly cured in from three to five days, during which time the patient will be permitted to make moderate use of the part. In cases of long standing a varying length of time will be required, but improvement will be marked and satisfactory from the first. Severe sprains, complicated by rupture of the ligament, are satisfactorily treated in the same manner, and though the time required to effect a cure is longer, progressive improvement will be marked.

When there is an abrasion in the vicinity of the sprain or bruise, avoid placing the electrode or making an application of the brush discharge directly to the open surface, as it will be too painful, the most of the current entering at the injured spot.

After a *fracture* is united, great benefit may be derived

from static applications, both to give tone to the muscles which have been at rest and to remove incidental œdema, which is apt to be present. Success in this class of cases may be directly attributed to the effects of lessening congestions, and at the same time hastening the processes of repair.

We will add, for emphasis, that, from results in uncomplicated traumatic injuries, we have an unquestionable demonstration of the fact *that the electro-static administrations do lessen congestion.*

IV. In the management of the rheumatic and gouty diatheses, as well as the conditions present in rheumatoid arthritis, the results of treatment may be said to be threefold. (1) There will be in most cases a prompt relief of the local condition; (2) a marked improvement in the patient's general health, and (3) a decided increase in the aggregate of solids eliminated with the urine.

The first is due to the effects upon local metabolism and the lessening of the congestion present; the second to the general effects upon nutrition, and the third (a very important one) shows a disposition towards the elimination of the products of imperfect combustion which have been locked up in the tissues.

RHEUMATISM

is a diathetic disease, of which a true ætiology is little understood, and, whatever medicinal treatment we employ, its use is empirical. In rheumatism undoubtedly, as in gout, myalgia, and rheumatoid arthritis, there are two indications for treatment—the diathesis and the local manifestation. In acute rheumatic fever, undoubtedly the indications for medicinal treatment is of first consideration. With the rheumatic diathesis, however, all medicinal treatment seems to fail and the opinions and remedies are numerous and variable, as in all diseases for which no satisfactory plan of treatment is recognized.

The associated conditions present with the rheumatic diathesis may be attributed largely to functional inactivities resulting either from physical organic defects, or improper habits of diet or exercise, or more or less of each or either.

Franklinism we believe, from analogy and experience, well meets the requirements to relieve both the constitutional and local conditions; at the same time, the correction of the habits and diet in whatever may be found to affect the individual status is essentially indicated.

The constitutional treatment should be thorough and general, receiving as much attention as the treatment of the local manifestations. Apply the block tin or lead electrodes closely, securing them with bandage to the affected joint, employing the wave current with as long a spark-gap as can be administered without causing painful muscular contractions. If two or more large joints are affected, or for some reason it is desirable to make an application to the abdomen, or back, or over the liver, with a view to increasing the activity of its functions, the modified wave current may be employed, as shown in Fig. 14. The advantage of the latter is that two or more large joints can be treated at one time, when, with the wave current, there might not be sufficient energy to produce the desired effect upon but one. The rheophore connected with the machine will produce the more potent effect, which the electrodes may be variously arranged to equalize. It may be varied by placing the electrode receiving the stronger effect upon the less sensitive joint, as the knee, and the other on an ankle; or by using a larger electrode to one and a smaller to the other; or by connecting several electrodes which have been secured to more sensitive joints to one point, as the Leyden jar, and one or more electrodes similarly placed to other joints, or to an indifferent surface, as the abdomen or back, to the machine. It will be easily seen that by such means much time can be saved when many joints require treatment; but, to obtain the best results, considerable tact and experience will be required to equalize the effects.

To obtain the desired results upon the local congestion, the vibration should be intense and the oscillations frequent. When there are few joints requiring treatment, and the capacity of the machine at the time is capable of producing the desired intense vibratory effects, the wave current (Fig. 11)

is to be preferred because the tonic effect is in proportion to the length of the spark-gap—other things being equal. In any event, one administration of the wave current for at least fifteen minutes should be given during each sitting, for its effect in stimulating secretions and excretions, so important for the relief of rheumatic conditions. The time devoted thus to each joint should be not less than fifteen minutes, and daily until the acute symptoms subside.

In addition to the wave current, or condenser current, sparks will be indicated in proportion to the depth and chronicity of the lesion. No form of administration is so effective in the production of local effects upon deep structures, and for removing the products of inflammation, as long, clean, indirect sparks. We therefore find them indispensable, and effective, in rheumatism affecting the hip, knee, ankle, and shoulder-joints especially, and often in the smaller joints as well; their use always following an application of the wave current.

A general administration of sparks (in lengths proportionate to structures), ending with an active general friction applied very rapidly over the whole person of the patient, is a most valuable measure for clearing the tissues by promoting a general and active metabolism. They may be administered in a very rapid and unobjectionable manner, to which the patient will consent. (See "Friction Sparks.")

Another measure invaluable in the treatment of rheumatism is the brush discharge, and, if time will permit, it will be found of advantage in the treatment of each case, and sufficient for its local effect, in a very large number of cases. No form of administration will give greater satisfaction in any affection than the brush discharge in many cases of acute articular rheumatism, after an administration of ten minutes, during which interval the wooden ball is moved rapidly about over the affected surface. The relief from pain is usually prompt and enduring; much swelling will often disappear during the administration, and a complete disappearance of the trouble may take place in a few days. The technique is simple and requires but little skill. (See "Convective Dis-

charges.") The material of which the wooden electrode is made is a matter of the utmost importance—soft maple is one of the best. The writer cannot yet demonstrate it and the literature on the subject is not along the line of the above plan of treatment; but, so far as we have had opportunity to determine, we believe that electro-static treatment of fairly young and robust adults, when continued for sufficient periods of time, will effectually cause the elimination of the materials which seem to induce the acute attacks.

MYALGIA.

Muscular rheumatism, wherever it asserts itself in the muscular system of the body, is one of the affections in which electricity, especially static, has long been recognized as a specific. Sparks—long, short, and friction—have held monopoly in these cases, but the wave current greatly aids in the severer forms of lumbago, and may be wisely employed in all chronic and severe forms; as may also the brush discharge, which very effectually meets the indications.

GOUT.

An attack of acute gout can either be cut short or greatly alleviated by the use of the brush discharge, or the wave current, in conjunction with the usual colchicum. The relief afforded by an application of the brush discharge to an acute gouty arthritis is most gratifying to both physician and patient, when pain ceases and swelling diminishes during a ten- or twenty-minute administration. If the attack is acute, and it is possible for the patient to receive two treatments in twenty-four hours, during the first days of the attack, it will hasten favorable results. We believe that time will demonstrate that no plan of constitutional treatment is so well calculated to promote the elimination of gouty accumulations in the system as the properly regulated and systematic administration of static electricity; employing the same general plan advised in the treatment of rheumatism. Such treatment

should be thorough and persevered in for months, in conjunction with a well-regulated diet.

RHEUMATOID ARTHRITIS.

Since the writer first became familiar with the remarkable effects of static electricity in the treatment of this most intractable disease, in 1898, he has sought in clinic and practice every opportunity to study and investigate its effects, and usually with gratifying results.

The observation since that time of a large number of cases affords a basis for the statement and conclusions which follow; taken from a paper read before the American Electro-Therapeutic Association at Washington, in September, 1899:

"SUMMARY OF RESULTS OF TREATMENT.

"I. Patient is always relieved by first, and greatly relieved by the first few treatments.

"II. If case is not of too long standing, the joints are not only made freely movable, but straightened, and Heberden nodes removed.

"III. After a daily treatment of from seven to ten days, a constantly increasing interval may generally intervene without return of symptoms.

"IV. During the course of treatment no extension of the processes will take place.

"V. We believe, though experience is not long enough to affirm, that in a large number of cases a complete cure will result."

Some of the cases at that time reported have continued well; all are better; and in not one has the process extended.

When instituting treatment of a new case, a fairly accurate prognosis of the result of treatment can be given from a radiograph taken at the time. Whenever the inter-articular cartilages are intact, as indicated by the light line between the phalanges, experience from results teaches that the other joint structures are also unaffected, and recovery of the affected joint will be complete; while in joints where that cartilage is

more or less involved the joint can never be normal, but will remain entirely or partially stiff after the active processes are checked. Radiography has also demonstrated the absence in every case examined of so-called chalky accumulations, as well as a different diagnosis between a class of cases distinct in every way from rheumatoid arthritis.

Investigation seems to establish another truth, valuable in determining the prognosis as well as course of treatment, i. e., rheumatoid arthritis seems to be in most cases a secondary disease following pelvic derangements in women, anæmia, nephritis, rheumatism, chronic malarial poisoning, and other constitutional diseases. It is not impossible that the cachexia present may so affect the trophic centers as to induce the processes of the disease. It is certain that stimulation of the centers, coincident with active treatment of the affected parts, does restore nutrition, remove the products of tissue necrosis, stop the progress of the disease, and cure the case, if the functional organic or mechanical cause of the primary lesion can be either removed or rendered less serious. In no case will the arthritis progress if the treatments are repeated at recurring intervals, the frequency always depending upon the individual characteristics of the case. The treatment of the primary lesion by mechanical or other means is a matter of as much importance as the treatment of the local lesion, if the results are to be permanent. The electrostatic treatment of many cases seems to be all that is required. Especially is this true in simple anæmia, rheumatism, neurasthenia, and some pelvic disorders.

The plan of treatment is essentially the same as in the treatment of rheumatism. The constitutional treatment is of the utmost importance and never to be neglected. Each finger should be covered with block tin—narrow strips, bound about the fingers, are the most convenient means. When applying tin about large joints, the writer usually slits the square or rectangular pièces of sheet tin (see Fig. 16), so that they may be adapted to the joints. For best results the wave current or derived currents should be administered to each joint affected, for from ten to fifteen minutes. For this purpose much

time will be saved by connecting several joints for one administration. When treating in this manner take care that the joints are about equally sensitive to the current. For example, the hands, wrists, forearm, and temporo-maxillary articulation will endure about the same current, and the shoulders, ankles, and feet a much larger voltage. As a rule the knees, singly or together, will require in an adult as much current as a machine will excite. The writer has frequently employed a spark-gap of ten to twelve inches when treating

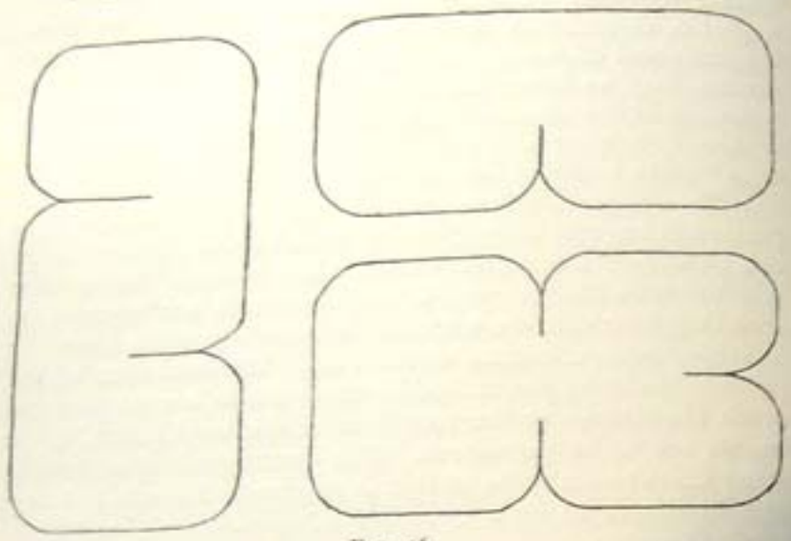


FIG. 16.

two knees with the wave current. The longer the spark-gap that can be employed in every case without causing discomfort, the greater the effect upon the local congestion.

A very liberal application of sparks—short ones one-half to three-quarters of an inch in length to the finger-joints, and relatively longer ones to the other joints—is indispensable, if success is to attend the treatment of rheumatoid arthritis. Painful as they are, an average of about ten sparks to each finger-joint seems to be required. These are best borne when

the operator takes a single spark from each joint, and passing back and forth along the rows of knuckles, completes the required administration.

Patients should be treated daily until the effects will bridge longer periods. The intervals should not be longer than three days, until cured. The promptness with which relief follows will vary greatly with the cases. Some will be cured within two months and others will require as many years. Particular attention must be paid to the constitutional treatment and the removal or relief of the primary disease, and satisfactory results will follow.

OSTEO-ARTHRITIS.

This affection is distinct from rheumatoid arthritis, and has long served to confuse the professional mind and literature on the subject. It occurs usually in healthy, well-nourished individuals of the better classes, and begins to appear at or about the menopause in women, and is very rare in men.

The examination of a large number of these cases with the Roentgen ray has convinced the writer that what have so often been considered chalky deposits are true osteophytic enlargements of the bones and usually appear at the last phalangeal articulations, as shown in the accompanying illustration. It is incorrect to consider them as of gouty origin, or in any way allied to gout. There is no cure for the condition when once developed. The application of sparks, as in the treatment of rheumatoid arthritis, will in most cases relieve the local pain and inflammatory swelling, and render joints otherwise painful constantly useful. The case represented in Fig. 17 has for two years received on an average two or three treatments monthly, going frequently two or three months without suffering or treatment. The osteophytic enlargements have not increased in size, nor diminished, since they have been under observation.

Sparks associated with the brush discharge give the best results, and should be administered in frequency according to the indications.

SYNOVITIS,

when not characterized by the presence of pus, should be treated in the same manner as the other forms of arthritis, with wave current, sparks, and the brush discharge. The results are uniformly successful, the time necessary to complete the cure depending upon (1) the length of time since its appearance, (2) the general health of the patient, (3) the presence of dense layers of fat over the joint. In the latter very long

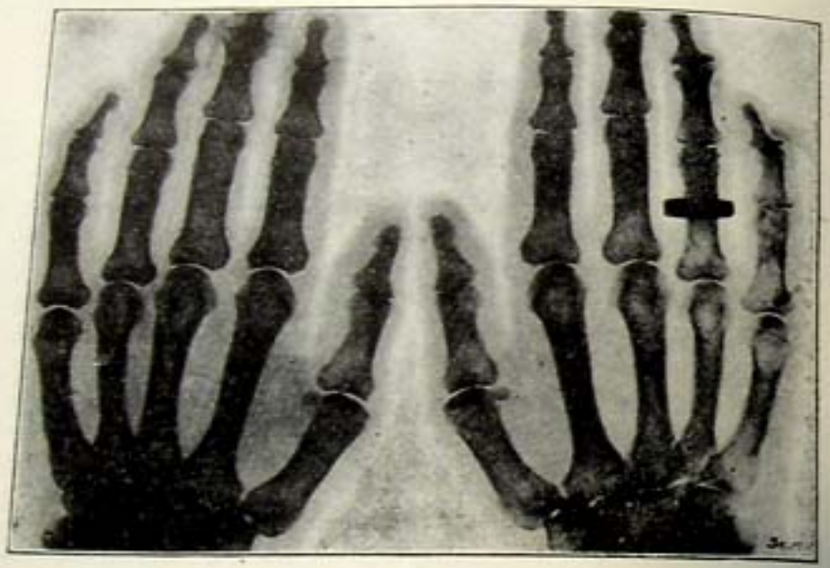


FIG. 17.

percussion sparks will be imperative, and much time will be necessary to effect a cure, because the vibratory action of the electro-static currents, or sparks, cannot be brought so effectively to act upon the circulatory and lymphatic structures through a thick, almost non-conducting, cushion of fat.

Many other affections might be included in this chapter,—as neuritis, coccygodynia, and myelitis,—but it is thought best to include them with other special classifications. The

fifth class, including such as nephritis, tonsillitis, and those conditions arising from functional inactivities and unknown causes, will be considered in a chapter on "Constitutional Disorders."

CHAPTER X.

THE PAINFUL NEUROSES.

Diseases of the nervous system characterized by pain may be due to (1) inflammatory conditions, as neuritis, or (2) arise from affections of the central nervous system, as tabes, or (3) as a symptom of malnutrition, or chronic poisoning, occurring with various cachexias, or (4) from reflex causes and from extreme exhaustion, as neuralgia.

Most of these painful neuroses can be relieved, and the larger part of them cured, by static applications, when they have not become too chronic, or if some internal organic lesion is not present to preclude the possibility. The greatest obstacle to successful treatment here, as in all cases, is the presence of a thick layer of fat betweeen the surface and the seat of the trouble. Deeply seated affections, as neuritis of the sacral plexus, or in a bony canal, as of the chronic cases of tic douloureux and cases of neuritis in regions where muscles are sensitive and contract under strong administration of the wave current, as of the branches of the brachial plexus in the arm and forearm, require special methods of application, q. v. Pathological conditions which interfere materially are the forms of sarcoma and carcinoma, tubercular disease of the bone or lymphatic glands, and various tumors pressing upon deep structures.

NEURITIS,

inflammatory in character, as the name implies, arises from exposures when from fatigue or a lowered state the reactions are below the standard; from strains or traumatisms, or from complicating inflammatory conditions, as rheumatism, rheumatoid arthritis, or Pott's disease of the spine.

Any nerve may become the site of neuritis. It occurs

most commonly in the sciatic nerve, the brachial plexus, and facial nerve. Neuritis is the cause of many *so-called* neuralgias, and is also present as a complicating condition of other inflammatory affections.

SCIATICA

is perhaps the most common and intractable of the forms of neuritis, when treated by methods other than the static. The localities most commonly the seat of the inflammatory process are at the sacro-sciatic notch where the nerve emerges from the pelvis, in the popliteal space, and the branches distributed to the foot. Quite often cases are met where it is difficult at first to determine the location of the lesion. In these it will generally be located in the sacral plexus, or in the region of the cord, when the prognosis may be in doubt from the various pelvic conditions that may complicate the case.

The diagnosis of the site or extent of the sciatica, or of any neuritis except within the cavities of the body or bony canals of the head, is easily made by applying sparks or the brush discharge along the course of the nerve, noting the points at which the severe pain begins and ends, and at the same time comparing with the effect at corresponding points of the opposite side of the body. A spark over a nerve, especially at the motor points, is always painful, but when applied over a part of the nerve the seat of the neuritis, the pain is intense. When determining the extent of a neuritis, it is only necessary to watch the facial expression of the patient during the application to mark the limits of the inflammation, as we map it out with the sparks.

The *prognosis* of uncomplicated neuritis, when accessible, is most satisfactory.

The treatment will vary with the conditions of the case. In acute recent cases, when the patient is muscular and not too fat, the wave current is all that will be required to effect a complete cure in a few days; the more recent the case the shorter the time needed, other things being equal. In fat patients, and chronic cases, it will be necessary to make use of long sparks to obtain the desired result. Over the foot and

leg, prolonged applications of the brush discharge will give satisfactory results. When employing the wave current, or one of the modified currents, select an electrode with reference to the capacity of the machine or current used, the extent of the lesion, and the tissues of the patient. It is an intense vibratory effect that is required, to which the affected nerve must be sensitive when but a small part of the possible current strength is employed, that it may be gradually increased until the sedation is complete, which will be determined by lengthening the spark-gap without increased pain. The electrode should rarely be larger than 4 x 4 inches, and under certain conditions, above referred to, it may be necessary to employ one of the desired currents, preferably the Leyden jar current shown in Fig. 14, in order to get the required intense vibratory local effect. When using this current, place the indifferent electrode upon the platform beneath the bare feet of the patient, or a large electrode upon the back, abdomen, or chest, where some indication may exist for its use.

At the beginning of each administration of whichever current, the electrode having been secured so that it will be firmly pressed to the affected spot, open the spark-gap to a point at which the patient can, without much discomfort, tolerate no more. As the sensation becomes less intense gradually lengthen the spark-gap, when, at the end of at least fifteen or twenty minutes, the sedation will be complete. If the result be satisfactory, there will often be little or no pain whatever for twenty-four hours. In such, a daily administration will effect a cure in a short time. In others the pain may return sooner, and require, for a few days, morning and evening treatments, after which the periods may be gradually lengthened. In other cases, especially those of three or more weeks' standing, the wave current will fail to produce the complete sedation required; in such long sparks should be applied directly to the affected nerve over the whole extent of the lesion, and they will, as a rule, accomplish the desired result. Test the effect by having the patient exercise the muscles in the vicinity of the affected nerve, by stepping off and on the platform, standing with the weight upon the affected leg, moving

the body in various positions, etc. If it is found that the sparks are giving relief, persevere until it is complete. Others say that they have known cases to be aggravated by the sparks. The writer, however, in records of more than one hundred cases has found none but what sparks would partially relieve, and not one was aggravated. The brush discharge, or prolonged administration of the spray, may assist in relieving some who are not too fat, or the case too chronic; the latter invariably requiring sparks. *Bridging* is of the utmost importance, and, when properly observed, we are satisfied that every case of uncomplicated sciatica can be cured by one or another of the electro-static modalities.

NEURITIS WITHIN THE PELVIS

occurs so often as a complication of other conditions, due to pressure or inflammatory processes in that region, that it is important to exclude a possible Pott's disease, carcinoma, or other tumor before undertaking the case, and certainly before giving any but a most guarded prognosis. That these conditions may be satisfactorily treated when uncomplicated the writer's experience has led him to believe.

Cases which we have treated have been successfully managed by the use of the wave current. When the lesion is in the lumbar plexus, it will be discovered by the effect of the intense vibratory action of a powerful current (4 to 6 inch spark-gap) applied at the back over that region, producing a painful sensation along the course of distribution of branches of the obturator and crural nerves. To as far as possible localize the application we would employ the derived Leyden jar current (Fig. 14), placing the direct electrode (the one connected with the positive pole of the machine) over the lumbar plexus, and several smaller electrodes at the points at which the principal branches emerge from the pelvis, which will be indicated by the pain produced by the previous administration over the lumbar region. Connect these smaller electrodes together with strips of tin or connecting cords and then connect with the inner coating of the smallest Leyden jar, and ground the outer coating and the negative side of the machine; gradually

increase the spark-gap until sedation is complete. This may require from twenty minutes to half an hour, and rarely less than fifteen minutes. The vibrations over the lesion, and the transmitted vibration from without along the branches of the plexus, and the electrical effects of the high potential currents, whatever they may be, certainly do relieve the congestion and cure the patient. The observance of *bridging*—observing the indicated frequency of administration—must be adhered to, as in the treatment of all conditions. The same general plan would apply to cord affections or neuritis of the sacral plexus.

BRACHIAL NEURITIS

differs in no essential characteristic from the conditions which have just been considered, and the principles of treatment are the same except when, in the branches which supply the arm and forearm, it is impossible to produce the necessary intense effects, because the contractions which are induced prevent the use of the required potential. It is necessary, therefore, to rely upon the *sparks, brush discharge, or spray*. Sparks, 1 1-2 to 3 inches in length, must then be administered directly over the inflamed and painful portion of the nerve. The great relief which follows these severe applications encourages the most timid patients to endure them. During the course of the application the patient should move the arm about, making all movements that cause pain; at the same time indicating such as are painful and the points to which sparks give relief. Let the operator bear in mind that the motor points and bony prominences are always painful to sparks, and that to the latter they do no good, and to the former only when the nerve at that point is a seat of neuritis, and much needless suffering from a superfluity of sparks will be spared the patient.

With patients who do not bear sparks well, it may be possible, in the first stages, to cure those in whom the nerve is not covered with thick muscles or fat, by using the brush discharge or the spray during each administration, until the pain is relieved. When pain on movement is thus relieved it is always fair to suppose, in any inflammatory

condition, the congestion is lessened; but experience with each case, noting the length of duration of the cessation of pain, will be a guide to the degree of effect upon the inflammation. If the relief is for but one or two hours, the next administration should be continued until a marked rubefacient effect is produced over a considerable area; failing in this, induce the patient to submit to sparks, which will succeed. The rubefacient action of the brush discharge is valuable in all cases of brachial neuritis, when the necessary time to produce it can be spared.

Neuritis in various other regions requires the same general plan of treatment as in the preceding special cases. *Facial neuritis* will be considered with the neuralgias, because it is generally so classified.

LOCOMOTOR ATAXIA

is a disease characterized by a degeneration of the central and peripheral sensory nervous system.

The ætiology is obscure, no certain cause being traceable in most of the cases. The fact that many patients present a syphilitic history has induced some writers to consider it the specific cause. Such observers, however, are largely in the minority. The position is taken by Gowers, "that there is nothing in the histological character of the lesion that can be compared with the morbid processes that are certainly syphilitic." "There is nothing, therefore, to warrant the opinion that any morbid germs deposited in the cord or nerves lead to the development of the disease." "It is probable that syphilis leaves behind it a predisposition to nerve degeneration, lowers in certain nerve elements the capacity for resisting morbid influences, leaves many patients in a condition analogous to one who inherits a predisposition to neural disease." Great diversity of opinion exists as to the percentage in which a syphilitic history *can* be traced. Some place it as low as forty per cent. and others as high as seventy-five per cent. It evidently does create a predisposition, but is not the cause *ipso facto*. The same conditions which may be attributed to syphilis are produced by other exhausting and enervat-

ing causes, as accidents (particularly concussion of the spine), exposure to cold, fatigue, exhausting diseases, excess of venery, and many others.

The pathology of the disease is characteristic. Cerebral centers are but slightly affected, while the centers in the cord, generally most marked in the lumbar region, are largely the seat of trouble.

Evidences of inflammatory processes, so generally absent in congestive conditions after death, are indicated by changes in the blood vessels (thickening of their walls) and overgrowth of the neuroglia which lies between and supports the ganglionic cells. The primary changes seem to take place in the ganglionic cells, which become atrophied or disappear, to be replaced by connective tissue. It is most probable that the lesion is of a congestive or inflammatory nature associated with a lowered constitutional state and marked by varying degrees of activity, the results of which are to be found only after death (pressure destroying and impairing the functional activity of the cells), but of a type favorable to the growth of connective tissue.

The symptoms, briefly considered, that are characteristic, are the pains; which vary from mild pains, apt in the first stage to be mistaken for neuralgia, to the severe boring and lancinating pains, the ataxic walk, girdle sensations, Argyll Robertson pupil, areas of anæsthesia, abolished reflexes, impaired function of the rectal, vesical, and sexual apparatus, and joint and tissue degeneration. Several of these symptoms are more or less constant in every case, and most of them occur at one time or another with sufferers in whom the disease runs an uninterrupted course. In no disease are the symptoms so variable and unaccountable as in tabes dorsalis.

The prognosis is variable; depending upon the stage of the disease, the severity of the lesion, the physical condition of the patient, and the character and frequency of the treatments. We believe that, in patients not afflicted with other organic disease, it can be stopped in its progress and many of the symptoms be decidedly relieved, and that in the first stages it can be generally cured; only conditions referable to irreparable or destroyed cells remaining.

Treatment of locomotor ataxia must meet at least three indications—the improvement of the general status, the arrest of the processes, and the relief of symptoms.

(1) If degeneration is the primitive condition, and the cause not a specific organism, but a lowered vital state, especially of the nervous system, the indication for treatment is the employment of means of restoration or regeneration.

(2) The inflammatory processes which are undoubtedly present and productive of destruction or atrophy of the ganglion cells, either by the pressure present in congested tissue, or by the action of the inflammatory process attacking the cell protoplasm itself, must be interrupted if the local lesion is to be arrested.

(3) The treatment which arrests the lesion will relieve the symptoms to some extent, and the electrical treatment, when applied to the symptoms in the manner to be described, creates by "ingoing impression," as shown by Morton, a return at least partial to activity of many centers, even during the administration.

Electrical treatment has for a long time been recognized by medical electrologists to possess merit in the treatment of tabes, but neurologists generally prescribe it only as they do the iodides. The fact is that favorable results can only be obtained from electrical treatment with a devotion to technique, which must be directed to the conditions, and time at each administration sufficient to obtain the desired effect, and a frequency of administration which will bridge over the gains. Observing these measures, *electro-static* treatment, at least, will meet many indications, and generally prove satisfactory to both physician and patient.

Ganglion cells that have been destroyed cannot be replaced or regenerated in any case. The patient must, therefore, be made to understand that restoration, other things being equal, will be relative to the number of cells destroyed, and the condition and surroundings of the cells impaired, which are unknown.

The *first indication* is met with possibly the judicious use of tonics and attention to diet, together with twenty to thirty

minutes' administration of the wave currents. The effects of tonic static administrations upon all nutritional derangements are energizing and restorative; evidenced, as has been shown in the preceding chapters, by improvement in appetite, nutrition, and activity of every body function. Such are the effects in all cases with locomotor ataxia patients not affected with other organic disease. No special administration of the wave current will be necessary when the local use is for a long enough period of time, and employing sufficient voltage, to insure the required effect.

The second indication to be met, the relief of the inflammatory characteristics of the lesion, is not only demonstrated to be relieved, but the fact that such lesion exists, if other evidence was not adducible, is also demonstrated; or else some other reasonable theory must be presented for the restoration of the functions, which does take place in so many patients that the results seem to be confirmatory.

The removal of the pressure from the ganglion cells, by withdrawal of the congestion, would permit a general restoration of their function, to a greater or less degree; while a theory of regeneration, or the substitution of new ganglion cells, would be contrary to fact. When it is so certainly a fact that congestion is removed from the deep structures of a knee or hip joint by static administration, it is not presumption to expect that the same thing will take place within the spinal cord. Certainly, no other fact will explain the relief afforded cases of anterior polio-myelitis, to be reported in a subsequent chapter.

For relief of the cord affection, place over the region or regions affected, a sheet-tin electrode three inches wide by eight inches long, and secure it firmly by placing a pillow against the patient's back; connect with the positive pole of the static machine, and administer the wave current, employing a spark-gap of four to six inches in length for at least fifteen minutes; and follow this with the same administration to the soles of the feet, for the same length of time. Another method is to employ the current shown in Fig. 14, chapter VI. Connect the electrode applied to the back with the

positive pole of the machine, and the one beneath the feet to the Leyden jar, and regulate the spark-gap to the sensations of the patient. When the latter plan is adopted, it will be best to close the current administration by disconnecting the rheophore from the Leyden jar, and making use of the wave current as first directed for fifteen minutes, for the tonic effects of the derived current are but moderate. Long sparks over the lumbar region are undoubtedly useful in relieving the central congestion in all cases. Such are especially indicated in very muscular or corpulent persons.

The third indication, the symptomatic, is of great importance, and contributes no small amount to the relief of the central lesion and the awakening of the liberated, but dormant, cells.

(a) *The pain*, the most distressing symptom of tabes, yields satisfactorily in almost every case to one or another of the modalities. Patients who were taking many grains of morphine daily for relief have, to the writer's knowledge, been able to abandon the drug altogether after a few weeks' treatment. The wave current, sparks, and the brush discharge have each given temporary relief when locally applied: one modality gives greater relief to one case, and others derive more benefit from another. The greatest measure of relief from this symptom, as from all others, is derived from the general and direct spinal application.

The Argyll Robertson pupil and other optic symptoms, when once present, have never been benefited by treatment in the writer's experience, nor in cases in records examined.

The areas of anæsthesia are easily discovered and outlined by passing the brass ball (the patient connected and the machine moving at moderate speed) over the patient's clothing.

The friction spark rapidly applied to such areas, at first imperceptible, causes after a short time a feeling of warmth, and later, in the most hopeful cases, becomes intolerable. It is the treatment *par excellence* for this condition, and at the same time contributes very largely to relief and reawakening of the function of the remaining ganglion cells. The effect is certainly significant when patients who had not been able to feel one foot with the other in bed for two years are again able to do

so, and gradually begin to maintain permanently a much improved, though not normal condition.

In the first stage in most cases, the sensation may be restored to normal, because no cells have been destroyed, but their functions impaired. The administration should be made very thoroughly to such areas, and at each administration to the lower extremities and body as well. In a few cases the upper extremities are involved, and must then be included in the attentions given.

The ataxic walk is caused by the anæsthesia, and is improved, as a rule, in proportion as the normal sensation is restored.

The abolished reflexes are rarely, if ever, restored by any treatment.

The impaired vesical, rectal, and *sexual functions* may each be greatly benefited by the stimulating effects of the wave current applied within the urethra, bladder, and rectum, and friction sparks above the pubes, and to the penis and perineum.

To the *tissue* and *joint degeneration* we would administer the brush discharge.

CHAPTER XI.

NEURALGIA.

another name for pain when applied to disease, has long been recognized as a misleading and unscientific term—classing a symptom as a disease. It can never be the correct thing to permit such professional license because an obscure or remote condition is difficult to diagnose. It is better to admit ignorance, and, when possible, find out the cause.

When a local pain is persistent, a local cause may be presumed to be present; in a few cases, however, the lesion will be found in the central nervous system, or at an injured point in the course of the nerve.

The pains associated with adynamic conditions, such as the cachexias, anæmia, and chronic malarial poisoning, are never constant, but flitting, and demand the indicated constitutional treatment.

Reflex pains also are not constant, but vary with the condition of the organ from which they originate.

Treatment first calls for diagnosis of the cause, after which, treatment of the pain and as well of the condition which causes it. Perhaps it may now be said—not scientifically, but from the therapeutical standpoint—that the scientific administration of Franklinism makes the diagnosis less imperative, since it relieves the local pain and the local congestion which may cause it, and at the same time improves generally the adynamic condition. On the other hand, such treatment becomes an aid to diagnosis by exclusion—a condition not yielding will, as a rule, be due to an organic lesion, local or central.

For the relief of pain all of the static modalities possess merit. We place them, from our own experience, in the following order of preference: viz., wave current, brush discharge, sparks, breeze, spray, static insulation (nutritional), and static induced current. The first four meet all demands and will be treated according to special indications in the following pages.

COCCYGODYNIA

is due in most cases to either an arthritis or neuritis; both generally intractable to all but the electrical treatment. The constants and coil currents have achieved small success in this painful affection, and electricity has, therefore, also been rated a failure by many. The old currents are impotent because they do not relieve the local congestion which is always present in an arthritis or neuritis. We have demonstrated the static modalities to be successful in every case which has continued the treatment when the products of inflammation have not formed deposits which restrict motion. The prognosis is generally good, and the time necessary to effect a cure will depend upon the chronicity and extent of the injury.

The wave current will give satisfactory results when applied by adapting a tin electrode to the region, and after securing it employing the current in the manner in which we treat neuritis for from fifteen to twenty minutes. If a trace of pain remains, it may be removed, in most cases, with either the

brush discharge or sparks; the former being indicated in acute cases associated with tenderness and possible ecchymosis resulting from an injury; and the latter in chronic cases, to promote the reabsorption of the products of inflammation.

INTERCOSTAL NEURALGIA

is, as a rule, caused by neuritis, and, when not due to pressure other than congestion, will be promptly cured by the same processes described in the preceding affection.

FACIAL NEURALGIA.

So-called neuralgia of the trigeminus is a very common and often stubborn affection. The exposure to which the face is subjected, and the fact that many branches of the nerve in this region pass through bony canals, or across bony prominences, make it prone to injury. Where slight pressure, from congestion of either the neurilemma or the structures surrounding the nerve, or from small tumors or exostoses, is present pain of a more or less permanent character results. One writer says that "neuralgia of the trifacial is the most frequent form, when the disease is due to malaria." So often is the condition due to a congestive hyperæmia that the early treatment of tic douloureux by the wave current, brush discharge, or sparks, acts as a prompt cure in most cases, and these methods promise very much in cases of longer standing. When a tumor, an exostosis, or aneurism is the cause, some temporary relief may be afforded, but nothing more can be expected. So also, when due to malaria, much relief may result from treatment; but the question of first importance is the treatment of the malaria.

The diagnosis of the cause of facial neuralgia is not always easy, or the term neuralgia would not be employed so often. The prognosis must be guarded in all but the recent cases, which yield promptly in all due to local congestion not caused by abscess or bone necrosis.

Treatment.—If caused by epithelioma, great encouragement is offered by exposure to the Roentgen ray. (See chapters on Therapeutic Radiography.)

The application of the wave current to a violent case of tic douloureux was the first revelation to the writer of its remarkable anodyne effects, which are now recognized by most electro-therapeutists in this country. When employing the wave current, select an electrode which will cover the face on the affected side, requesting the patient to hold it with the ball of the thumb; pressing it firmly to the affected or painful spot, connect by a rheophore, and start the machine, employing a very short spark-gap; opening it until the pain begins to be severe. At this juncture, in acute cases, many of the motor points of the face in distribution, of the nerve, become painful. If so, the patient should press the tin firmly with the fingers to such spots. The administration should be continued for fifteen minutes, during which time the operator should gradually lengthen the spark-gap. Care should be taken that this be done in the most cautious and delicate manner, as a sudden shock will be very painful and greatly disturb any patient. By gently withdrawing the rod with a screwing movement, at the same time consulting the sensations of the patient, it may easily be accomplished without casualty.

The brush discharge will give very great satisfaction in facial neuralgia. It should be applied over a surface considerably larger than the painful area (unless the whole face is involved, when the entire surface should be treated) until a distinctly rubefacient effect is produced.

Short sparks may be found of service in some chronic cases, but as a rule avail little when the other modalities fail. Strict attention to *bridging* will insure the best results. Acute cases will often require two administrations daily during the first days of treatment.

NEURALGIAS OF THE FOOT.

Podalgia and plantar neuralgia deserve attention here, because in most cases the static modalities give prompt relief.

Podalgia, painful heel, is a condition sometimes associated with flat foot, rheumatism, gout, and neuritis, and is especially liable to occur in persons who are much on their feet. The extent of the affection will vary from a small circumscribed

spot to the whole surface of the heel. A few will prove intractable, even to the electro-static treatment.

The usual means for treating painful affections have merit in most of these cases, and should be employed heroically, if the case demands it. The best results have been obtained by the writer from the application of long sparks, applied directly to the painful spot.

Plantar neuralgia is apt to occur, says Osler, after "cold-bath treatment of typhoid fever." It also occurs as neuritis or with gout or rheumatism, and is satisfactorily treated by the wave current and brush discharge. In this affection sparks are rarely necessary.

VISCERAL NEURALGIA.

Gastralgia, cardialgia, nephralgia, also neuralgia of the liver, rectum, ovary, and testicles, occur with neuropathic conditions, and are often associated with cachectic and other lowered constitutional states. All call for both constitutional and local treatment. There is probably no one agency that accomplishes more for these painful conditions than Franklinism. At the same time, far be it from us to disparage the use of other tonics or safe alteratives which, associated with proper diet and good hygiene, will hasten recovery.

The tonic effects of the wave current work wonders in these conditions and cannot be too strongly advised. It matters little where the electrode is applied to produce the energizing effects. Experience with very many cases, which uniformly improved in general health while receiving local treatment and no medication, both to the body and the extremities, has impressed the writer that with patients in whom there is a lowered condition of health, without organic disease, they are coincidently restored. On general principles, we apply the long spinal electrode for tonic effects, but we are induced to believe that when prolonged administrations, aggregating from twenty minutes to half an hour, of a current measured by at least a four-inch spark-gap, have been given, it will not also be necessary to make these applications for the effects to be sought for improving nutritional conditions. There-

fore, when called upon to treat these neuralgias, apply an electrode having a surface area of sixteen to twenty square inches directly over the painful surface, and continue the administration for at least twenty minutes, and the local and constitutional treatment will both have been accomplished. Daily administrations should be given for at least two weeks, and continued later every second day until health is restored.

GASTRALGIA

is promptly cut short during the attack in most instances, and when the treatments are continued for a sufficient period, generally cease to recur altogether unless persisting cause be present.

CARDIALGIA,

induced by a fatigued, poorly nourished, or overworked heart, is greatly relieved by the local administration, and often cured by a restoration to the normal conditions of health.

For angina pectoris we believe no treatment promises so much,—if atheroma of the coronary artery is not in an advanced condition,—because it lowers arterial tension, promotes the elimination of mineral salts, and preserves a constitutional equilibrium. In the treatment of false angina, occurring in neurasthenic and hysterical individuals, it is successful, as it is also in removing the associated affections.

In treating these conditions, apply an electrode about four inches square over the præcordial region, and treat the primary affection according to indications.

For relief of neuralgia of the liver or kidneys, apply the electrode and continue the administration for at least twenty minutes.

OVARIAN NEURALGIA

in most women requires tonic treatment, as well as relief of local pelvic congestion so often associated with the condition to which, when present, the pain is secondary. Apply the wave current over the painful spot, employing a large electrode when weather conditions are favorable to the use of a long spark-gap; continue for fifteen or twenty minutes. Another method often successful is to employ a large vaginal electrode connected to the machine, and the abdominal electrode over the ovary connected to the small Leyden jar, as shown in Fig. 14, Chapter VI.

The brush discharge, applied over a considerable area until a rubefacient effect is produced, will give marked relief, and, when applied daily over the lower abdominal region, will have a pronounced effect in lessening or removing pelvic congestion.

NEURALGIA OF THE RECTUM

should be treated by placing a large special electrode in the rectum and employing the wave current. If the case is not due to structural changes or foreign bodies, the result will be satisfactory.

NEURALGIA OF THE TESTICLE

is best treated by application of the brush discharge for from fifteen to twenty minutes. Few painful or congested conditions of the testicle will not yield to this modality. Great care should be taken that during the administrations accidental sparks do not pass to the testicle or the penis. (See Administration of Brush Discharge.) Sparks are not harmful, but so painful that a timid patient might not return.

MIGRAINE

is a superficial or deep-seated pain, usually confined to the temporal or orbital region of one side of the head, and in most cases associated with nausea. Heredity, neuropathic and adynamic conditions predispose to the attacks; and, in proportion as such influences can be checked, allayed, or normal conditions restored, can these sufferers be relieved. As in all nervous diseases of hereditary origin, those cases in particular are most intractable, and must be taken carefully in hand from the first appearance in childhood. The *indications* must be directed (1) to improving the general nutrition; (2) to lessening the nervous irritability by restoring, or establishing, a proper stability of the nervous system; (3) to correcting or removing

exciting causes as far as possible which induce attacks; and, (4) to relieving the attacks when they do occur.

The first two and last of the indications are perhaps better met by static electricity than any other plan of treatment, while the third will call for attention to various physical derangements—as eye strain, nasal affections, uterine disorders, gastro-intestinal derangements, and overwork or worry.

What has been already said of the nutritional effects of Franklinism applies here, as in all other conditions. That which induces general functional activity restores an equilibrium, and takes the strain from the overworked parts and sets the sluggish organs to their task, unless a physical disability (as an organic lesion) is present, and thereby does much to lessen nervous irritability. High potential electricity, however, does more than this to an overstrained and irritated nervous system. It quiets, soothes, and rests exhausted nerves; producing a sense of well-being, repose, and refreshing sleep.

The *prognosis* will vary with many conditions.

When *treating* for this affection, no specified time that it will take to effect the desired result can be promised. It will always depend upon the peculiarities and progress of the individual case. It will take months, and, in neuropathic individuals, a longer time, and in a few it may be necessary to keep up treatment indefinitely to maintain an improved status that has been established; and in still other rare cases, especially with otherwise healthy individuals, the treatment will neither influence the frequency nor the severity of the attacks.

The *treatment* during the intervals between the attacks should consist of administrations daily, or upon alternate days, of the wave current for from twenty minutes to one-half hour at each time. Apply an electrode, having a surface area of from sixteen to twenty-four inches, to any portion of the trunk of the body where there may be indications for local treatment, over the upper or lower abdominal or lumbar region; or a long spinal electrode over the vertebral column. Adapt the spark-gap to the physical conditions of the patient. During an attack observe the same rule of applying the electrode, and

at the same time place the point of the stand electrode over the patient's head, at a distance at which it will not interrupt the spark-gap. In some patients the breeze, thus applied to the head, seems to aggravate the pain; with such, the point placed in front of the knees, at the same distance as before, will, as a rule, have the desired effect. The polarity affects patients differently. We, generally, employ the positive insulation, varying it to the idiosyncrasy of the patient. The noise of the discharging spark-gap will aggravate some of these patients, when the balls must be widely separated. The brush discharge, applied to the aching head, will afford great relief in very many cases, while to a few it will prove an aggravation.

If care is taken to discover the idiosyncrasies of patients and regulation of dosage, few indeed will not be relieved.

HEADACHE.

The same general principles apply to the treatment of other headaches as to migraine; bearing in mind first to remove the cause, when possible.

CHAPTER XII.

GENERAL TREATMENT OF PARALYSIS.

Paralysis is "a loss or diminution of the powers of contractility in the voluntary or involuntary muscles, or of perceiving sensations."

Such a condition, occurring in a large or small portion of the body, may be induced by injury, degeneration, or pressure exerted upon the corresponding centers in the brain, the spinal cord, or in the course of the nerve between the centers and its peripheral distribution. The two former are termed central, and the latter peripheral, paralysis.

The degree of recovery will depend upon (1) the promptness with which the cause, if a central lesion, is removed; (2) the maintenance of the nutrition of the parts paralyzed in the interval between the onset and the recovery, if possible, of the normal function, and (3) the employment of physical

or medical measures which shall facilitate the removal of the cause or the maintenance of nutrition, or both.

The continuance of pressure upon ganglion cells, whether from a clot congestion or gumma, causes their destruction within a brief period of time. Likewise, cells cut off from nutrition by obstruction of the blood channels, by thrombosis or embolism, soon degenerate. Ganglion cells, once destroyed, are never restored, nor the function of the parts in the corresponding nerve distribution.

The *prognosis* of a given case of paralysis, then, will depend upon so many unknown conditions that, in most cases of central origin, it should be very guarded. In peripheral paralysis, however, the prognosis is generally favorable.

Paralyses caused by brain lesions will be associated with a very small degree of atrophy, to which the cases due to lesions of the cord show a decided contrast. The marked atrophy in the latter is undoubtedly due to the involvement of the trophic centers which influence nutrition, while in the former, and in peripheral paralysis, only the atrophy of disuse will occur. Peripheral paralysis will, in most cases, be recognized by the history, peculiar features, and generally prompt recovery. In some, however, it will be difficult to locate the lesion.

The general *indications* for treatment are, (1) if possible, to remove the cause, (2) to preserve the local nutrition of the parts paralyzed, and (3) to preserve the patient's general health and nutrition.

The causes, for the purposes of consideration, we will classify as (1) obstructive, (2) traumatic, (3) congestive, and (4) specific.

The *treatment* in many instances will combine with the electrical administration, medical or surgical measures, to which it is only possible to allude in the most general way, for, while such measures are often invaluable, it would not be practicable to treat them to any extent in a work on electro-therapeutics.

The remedy for removal of obstruction or pressure due to pathological conditions (which amounts to the same thing) is

one which will assist or promote reabsorption, or the establishment of the collateral circulation to supply the parts cut off. In this line very little can be accomplished—nature's provisions alone can bring about the restoration. Strychnine, to quicken the activities, and tonics and nutritious diet do much. But when possible for the patient to receive the tonic static administrations, which increase secretion, promote absorption, improve general nutrition, and relieve arterial tension, their value is certainly apparent.

Traumatic cases, when associated with depressed fragments or portions of bone, or a disarticulation or fracture of the vertebral column, first demand surgical measures. Later these cases, as well as those of concussion, in which congestion, active or passive, from the very nature of things must result, call for the same active local treatment as congestions generally, the consideration of which follows.

The *congestive* lesions of the brain or spinal cord are the most common of all causes of paralysis, being more or less a factor in all obstructive and mechanical cases, and from this fact we look for the greatest measure of success from electrostatic administrations in the very earliest possible stage of the affection. When making this statement it is with a full realization that it is in direct opposition to the long-established dictum of neurologists and electrologists. In defense of this departure it can be explained that when electricity has been employed in paralysis, until possibly within the past few years, it has been either the constant or the interrupted (faradic) currents. To the former can be attributed injurious effects due to electro-chemical action, and the latter was so deficient in electromotive force that no effect whatever was made upon the inflammatory conditions within the spinal canal. Now that it can be demonstrated that either the vibratory or electrical effects of currents of great potential, or the combined effects of both, do materially and efficiently lessen deep local congestion, what contraindication can be presented against their employment in inflammatory cord or brain affections? If a deep knee or hip-joint affection of such character can be relieved, why not a congestion within the spinal canal. Such

was the writer's premise more than two years ago; and experience with an ample number of cases of his own, and by his advice in the cases of other physicians, has proved that the theory was correct. The two following cases of anterior poliomyelitis, the first of which was reported by the writer in a paper read before the Post-Graduate Clinical Society of the New York Post-Graduate Medical School, in a paper entitled "The Electro-Static Treatment of Some Forms of Paralysis." A child, thirteen months of age, after six weeks' treatment in the clinic of an able neurologist in New York, was referred to me, in the following condition: Complete paralysis of both lower limbs, except power to move the toes on one foot, and the reaction of degeneration well marked. When the child was brought to the office on the morning after the first administration, he could move the feet at the ankle joint, and on each subsequent day there was additional power of motion, and after six treatments he could move ankle, knee, and hip joints with ease and considerable force. The case then disappeared; the mother, a Polish Jewess, thinking the child cured. The other case was referred to me by Dr. A. H. Allen of Gouveneur, N. Y.; and I herewith give the doctor's report of the case in a communication received about one year later:

"F. F., a boy aged fifteen, previously healthy, was taken in the night of March 3, 1900, with fever, vomiting, and pains in the back and legs. On trying to get up in the morning he was unable to walk. During the next forty-eight hours he became entirely paralyzed, excepting his right shoulder muscles, which did not become involved. The paralysis also extended to the right side of his face. He was completely helpless. I prescribed the usual remedies, but there was no improvement in his condition.

"A few days after this business called me to New York, and I consulted Dr. Wm. Benham Snow in regard to the case. He advised me to begin treatment at once with static electricity, and instructed me in the method of using the current for this particular case. On my return, two weeks after the boy was attacked, I found there had been no improvement.

The muscles of his limbs were very flaccid, and atrophy was well marked. March 18 I had the boy well wrapped in blankets and brought to my office, and began the electrical treatment, as instructed by Dr. Snow, which consisted of the Morton wave current to his spine and frictional and indirect sparks to the whole surface of his body and extremities.

"For the wave current I employ an electrode 10 inches in length by 1 1-2 inches in width. I employed the current for twenty minutes to the upper portion of his spine, and then the same length of time to the lower portion, following this with the frictional and indirect sparks. This treatment was employed daily for two weeks, and then every second day.

"The effect of the treatment was almost magical. After the sixth treatment he was able to walk through two rooms in my offices to the operating room. He continued to improve steadily, but his left hand and arm were least responsive to the treatment, and he did not regain their entire control until some time in August. Since then I have been treating him very irregularly, as he thinks he is well.

"He was able to row a boat and play ball and football during the latter part of the summer and fall, also to hunt and fish.

"There is still some atrophy of the muscles of both hands and forearms, and a little in both legs below the knees. To see him walk one would hardly notice anything wrong with him, unless they were very observing. He does any kind of work he chooses to do, and there is no difference in the strength of the limbs on either side.

"Each treatment was of about forty-five minutes' duration; twenty minutes each to the upper and lower portions of the spine, and about five minutes to the indirect and friction sparks. With the wave current, the spark-gap was about one inch at the beginning of each treatment, but was gradually lengthened to five or six inches. (The machine was an eight-plate Holtz machine, having plates thirty inches in diameter.)

"I am fully satisfied that, had the treatment with electricity been commenced as soon as the disease showed itself, the atrophy of the muscles would have been prevented.

"This seems to me an exceptionally good result for so severe a case of anterior poliomyelitis."

This case so well illustrates both the method and results of static treatment that, with the doctor's consent, I have included the record in full.

The same results have been obtained in other cases, and without exception, when the treatment has been instituted early. After two months have elapsed, however, the prognosis is very different and the treatment less satisfactory. In other words, when the pressure of the inflammatory process, or its effects, have not been relieved for so long a period, the ganglion cells perish, and paralysis then persists. It is certainly wise, however, to pursue the treatment so long as there is any improvement, because the disability may have resulted from a temporary involvement of the trophic centers, and many ganglion cells may not have perished, but their relations to the impaired muscles have become such that the performance of their functions remains unimpaired. The results from treatment can be explained in no other way. After a year has elapsed the chances of improvement are poor indeed. Cases of anterior poliomyelitis have been chosen, to illlustrate the fact that congestive conditions can be relieved by the electro-static modalities. The other affections of a congestive or inflammatory character are to be considered in the same category, as has been shown in the preceding chapter, when considering the treatment of tabes. The management in all cord cases is practically the same as there described, and we will not repeat, except to impress the importance of administering the current with sufficient energy to reach the part affected; while, when treating very large muscular or fat individuals, it may require relatively small electrodes and a spark-gap of ten or twelve inches—there is no danger of making it too great, if it is not disagreeable to the patient. An intense penetrating effect is demanded.

When the lesion is of the brain less can be accomplished, but the wave current over the cervical region, and the brush discharge vigorously applied over the scalp, will be fairly effective.

In cases of Bell's palsy no measure is so prompt and effective, because it is, as a rule, due to a congestive lesion. The writer has not infrequently known cases, which have come under observation within the first days, to be cured within a week. The cases in which the lesion is supra-nuclear or cortical, which are relatively rare, are recognized from the fact "that the upper muscles of the face are but little affected (the orbicularis palpebrarum and frontal muscles), the muscles which go to the angle of the mouth suffering chiefly."

The peripheral cases are most commonly of neuritic origin, arising from exposure to cold, as from draughts of cold air, and are promptly relieved by the administration of the wave current and brush discharge, if treated early.

The application of static electricity to the relief of congestion is to all intents and purposes the same, without regard to the location, for it is never employed with danger or possible risk to the structure of organs, even of the brain or spinal cord,—because, however high the voltage, the amperage is infinitesimal. Only judgment, tact, and patience are required to obtain generally satisfactory results.

Paralysis arising from a *specific cause*, as syphilis, calls for specific treatment, with a view to removing the gumma tumor that is supposed (rarely demonstrated) to be present, and the mixed treatment, or some other, may be followed by recovery. In such cases the administration of Franklinism for its nutritional effects, if for no other, is certainly beneficial.

The second general indication, to preserve the local nutrition of the parts paralyzed, and promote the general health and nutrition, requires attention from the onset of the affection, if an early and complete restoration is to be expected.

The maintenance of nutrition in health requires, in addition to a supply of nutritive pabulum, two things—the activity of the vital functions and a proper amount of activity of the motor mechanism. When either is interrupted, every part suffers.

If the action of the trophic centers in the cord, which are now believed to control the nutritive processes, is impaired, thereby complicating the paralysis, the part affected rapidly becomes soft and atrophies. In brain lesions the motor

mechanism only suffers from disuse, and thereby only secondarily affects the general nutrition. In peripheral paralyses, if exercise of the other portions of the body is not thereby impaired, only the part paralyzed suffers.

If the general health of the individual is not good at the onset of an attack of paralysis, restitution will be relatively slow, and the utmost must be done to assist and even stimulate the normal activities.

We believe that, while the attention to diet, daily evacuations, judicious use of tonics, and regulation of exercise (when possible) are all important, no measure so well meets all the indications for improving or maintaining nutrition as static electricity. (1) It tends to preserve the balance of the nutrition of exercise and the nutrition of restoration, and thereby retards the process of degeneration. (2) The qualities of the currents are such that no unfavorable electro-chemical action takes place to impair the beneficial effects. (3) The effects are searching, penetrating, and potent; in which qualities it surpasses all other forms of electrical administration. (4) Applied with the patient insulated, local administrations are tonic and constitutional as well. (5) Local applications induce reflex actions in cerebral cases, acting as a *vis a tergo;* not performing the action for the part, as when it is massaged. In other words the normal relations of center, nerve, end plate, and muscle to action are preserved, pending a possible recovery, in which the masseuer fails, because he moves the limb while the parts are passive. (6) Contractures never take place during a course of electro-static treatment, nervous irritability is allayed, sleep promoted, and normal equilibrium preserved.

The static modalities of value in preserving and promoting nutrition are sparks (long, short, and friction), the wave current, and the brush discharge. No modality calls forth so well a healthy responsive reflex action as sparks, long and short, according to the indications—short sparks to small muscles, and larger ones to larger muscles and when a thick layer of fat overlays the muscles to be treated.

Over paralyzed muscles the applications should be numerous,

not alone for exciting muscular contraction, but also to stimulate all local activities. For the same reason it is the writer's custom to make a thorough application of the friction sparks over the paralyzed areas. When anæsthesia is present, the friction sparks should be applied for a considerable time, after which in many cases partial or complete return of sensation will be experienced during the administration, to be followed later by partial or complete recovery. In paralysis of cerebral origin, peripheral paralysis, and in the treatment of tabes dorsalis sparks are of inestimable value.

The *wave current* should be applied, when possible, for its general nutritional effects, to every case of paralysis.

Its local application, when a spark-gap of at least four inches in length is continued for a period of twenty to thirty minutes, will preclude the necessity also of a tonic administration. The wave current is also indicated over local peripheral congestion and paralysis originating from affection of the cord, as previously shown. When the brain is the seat of the lesion, applications to the cervical region may be of some service. Except the scalp is shaved the wave current cannot be applied, and even then the writer's experience to the present time has derived no results that warrant its employment.

In the treatment of anterior poliomyelitis in young children, in addition to application over the spinal cord, we put up the affected limbs in a bandage of tinsel braid, and use the wave current, with a spark-gap just as long as can be used without inducing muscular contractions. It is best in these cases, we believe, unless the child is very small, to treat but one lower extremity at a time, but always both at the same sitting. When treating very small children it will be necessary to make use of a child's armchair, or to instruct the mother to hold the child, at the same time pressing the palm of the hand *constantly* against the outer metal surface of the electrode or braid—otherwise the mother could not hold the child, for the passage of sparks through the clothing.

The *brush discharge* is valuable for its effect over areas of congestion and hyperæsthesia, for relief of pain, and as well, to a satisfactory degree, for its nutritional effects. It is the

form of application *par excellence* to the scalp, and often affords great relief to an aching head.

The other modalities may be found of some value, but are, as a rule, not sufficiently effective to be indicated.

CHAPTER XIII.

PATHOLOGICAL MUSCULAR CONTRACTIONS.

Muscular contractions are induced by stimulation or irritation of a nerve center, axis cylinder, or the end plate,—centrifugal or centripetal,—and are voluntary or involuntary. The voluntary contractions, subject to the will in certain instances, from habit and without manifest source of irritation in neuropathic individuals, become involuntary, as is the case in one type of convulsive tic which is amenable to suggestive treatment. The involuntary contractions are reflex in character, and comprise those which act in performance of nature's normal functions governed by special centers which control the natural processes of life, and those which arise from central or peripheral pathological conditions.

Muscular contractions classified by symptoms may be divided into spasms, contractions, and tremors. The first may be subdivided into two types, clonic and tonic. Clonic spasms are characterized by alternate contraction and relaxation of the muscle or group of muscles affected. Tonic spasms are those in which the action of the stimulant is constant or recurrent, with a frequency that maintains the muscle in a state of fixed contraction. When clonic spasms are general, they are known as convulsions. A contracture may be defined as a condition in which the contraction of a muscle or a group of muscles maintains a limb in a fixed condition of some degree of flexion or extension. Tremor is a condition of slight recurrent contraction, physiological after exertion or fright, or pathological under certain abnormal conditions.

The *indications* are, as in all cases, the removal of the cause —either an existing source of irritation, when present, or a

nervous susceptibility which permits undue reflex contractions which, under normal conditions, would not be induced.

The *prognosis* in all cases will depend upon the chronicity of the case, or the organic character of the lesion, as concerns the central nervous system.

Peripheral affections, when not of over two years' standing, as a rule are capable of being cured, but often require patient application. In accord with the rule in all affections, the time necessary to effect a satisfactory result, other things being equal, is in proportion to the time which the condition has existed. In cases of central origin, if the affection is functional, from whatever cause, the prognosis again is favorable in proportion to the chronicity. The history of the case and the careful differentiation and diagnosis must afford the basis of prognosis.

In the *treatment* of these cases the high potential electrical modalities, associated with hygienic and tonic measures in cases of non-specific origin, offer effective means of relief.

In these, as in the pathological conditions considered in the preceding chapters, such favorable results are due to (1) the constitutional tonic effects; (2) the local effects upon inflammatory (irritating) conditions; and (3) the sedative effects upon overwrought nervous conditions. The general principles of administration apply here as in other affections, but some special features of method call for consideration.

EPILEPSY.

When not due to traumatic causes, but occurring in children of neuropathic parentage, very much can be accomplished to prevent it from becoming established by removing all irritating influences, correcting diet, and employing systematic administration of static electricity, both for its general tonic effect and for the relief of nervous irritability. The wave current is the choice of modalities in these cases. Place over the abdomen or back a metal electrode having a surface of about sixteen square inches. The administrations should be daily, or every second day, for a period of not less than twenty minutes, employing a spark gap of from two to five inches, accord-

ing to the age or condition of the child. This course should be kept up for at least a year, or longer if there is improvement, but a disposition to recurrence. If no lessening of frequency is noted after months of treatment, continuance will as a rule be of no avail.

CONVULSIVE TIC.

Very many of these cases are habit cases, induced by some trivial local source of irritation or reflex influence not of central origin. In such, static electricity plays a double rôle, and is uniformly successful if applied early. (1) It lessens the irritability, and (2) acts as a powerful suggestive influence when systematically employed.

Most cases of central origin are not due to any traceable organic defect, but are induced by functional derangement. Such are capable of being cured if not of too long standing. For treatment apply a metal electrode covering the affected muscles and held in position with the hand, and employ the wave current with as long a spark-gap as can be used without causing painful muscular contractions. Sparks to the region will also render the results more effective in some cases. If the condition is suspected to be of central origin, a large electrode to the back or abdomen should be used, as in epilepsy, for an additional fifteen minutes for its general effect. Under this régime there are few cases of not more than two years' standing that will not yield.

BLEPHAROSPASM

May be considered in the same category with convulsive tic, and treated in the same manner locally. It may be necessary, in making the application over the eye, to take off the ground chain when using the wave current. In this be guided by the patient's sensation. With the ground chain in position it will not be possible to use a spark-gap of more than one-quarter inch, which, during periods of humidity, will discharge the machine. An advantage with sensitive patients in using the current with the ground chain removed is the fact that the increase may be made by insensible gradations, and without

causing unpleasant shocks to the patient. When using the grounded current, lengthen the spark-gap with the greatest care, to avoid unpleasant (not dangerous) sensations to the patient. This is best accomplished by a screwing movement with the hand upon the handle of the discharging rod.

CHOREA.

In chorea we have to deal with a neuropathic condition in many respects analogous to epilepsy. The treatment is essentially the same, except that the administrations should be as in an acute disease—daily, for at least twenty minutes. In this disease the specific remedy, arsenic, is indicated, and should be used in conjunction with the tonic sedative, static electricity.

HICCOUGHS.

For the treatment of this often distressing and dangerous affection, apply a metal electrode having a surface area of sixteen to twenty square inches over the diaphragm, open the spark-gap gradually four to eight inches, and it is surprising how promptly the spasms are interrupted. Continue the administrations from thirty minutes to one hour, and repeat the treatment daily, or oftener, if the paroxysms recur.

THE OCCUPATION NEUROSES.

These affections occur as a rule in neurasthenic patients, or those of strong neuropathic predilections.

The indications for treatment therefore are constitutional as well as local.

The prognosis generally depends upon the common rules governing chronicity. Not every case will be cured.

The modus operandi is practically the same in all cases, and the different types will, therefore, be treated collectively. Whether the sufferer be writer, typewriter, pianist, telegraph operator, or barber, it will be the flexor group of the right hand which is affected except in left-handed persons. While the writer has cured patients suffering from the affection

without interrupting the occupation, it is not the best plan, and, in cases of longer periods than a few months' standing, should not be considered. In all cases employ the tonic treatment, with the wave current for its constitutional effects, for at least twenty minutes, and thereby relieve the general nervous irritability and improve the processes of general nutrition. For this purpose the spinal or abdominal electrode and a three- to six-inch spark-gap are indicated. Locally a liberal application of short sparks (one inch) to the muscles of the forearm and ball of the thumb, followed by friction sparks, serves the best purpose. Their action is to improve local metabolism and nutrition, stimulate normal reflex action, and, with rest, or very moderate use of the parts, will effect a cure in most early cases, and is the best measure in all cases. In the stubborn cases the wave current may be employed, either by applying the tinsel braid or by placing the arm in a water bath for a period of fifteen minutes. The administrations should be made daily until a cure is effected, or the treatment abandoned.

CONTRACTURES.

These conditions are secondary to central or peripheral stimulation constant in character, or to opposing paralysis of muscles, and are curable in most cases if treated before the structural changes which eventually shorten the muscles are not too far advanced. Whenever an inflammatory process persists for a length of time in the structures of a movable joint in any part of the body, groups of muscles which control the action of that joint become contracted, and the limb becomes fixed in extension or flexion, because long-continued irritation of the nerves induces contraction of the muscular filaments. If the condition has been present for only a few months, the prognosis is excellent and the condition will be relieved when the inflammatory joint affection is cured. (See Treatment of Joints.) At the time of treating the inflammatory joint affection, apply sparks liberally along the course of the contracted muscle, which means serves better than any other to overcome muscular contraction.

In addition, employ systematically therapeutic exercise. In

cases which cannot be induced to submit to sparks, the wave current will succeed, but requires a longer time to accomplish the same result. Contractures occurring with paralysis may be prevented, if treatment is initiated while the muscles may still be extended, by gentle manipulation. In anterior poliomyelitis (q. v.), either electricity or orthopedic measures will prevent contractures. The objection to the constant use of fixation braces is that a degree of early restoration which is often possible is prevented, and the opposite group of muscles atrophy, as well, to an extent from which they will never recover if restrained throughout the period of development. If the orthopedic appliances are used, there should be a considerable period of each day during which the muscles should be exercised, and the wave-current or sparks (preferably the latter) should be administered at least three times weekly. (See Treatment of Paralysis.)

Contractures in hysteria, like the condition itself, yield to static electricity as they do to no other method of treatment. Sparks applied directly to the contracted muscles, or, when not tolerated by the patient, long administrations (twenty minutes) of the wave current, as strong as it can be given without causing painful muscular contractions, will succeed, but not so promptly. Contractures associated with other affections, as paralysis agitans, lateral sclerosis, cramps, etc., etc., should be treated on the same general principles, and the prognosis will vary with the chronicity of the affection and the organic nature of the primary lesion.

ATHETOSIS.

This condition often follows hemiplegia in childhood, and is characterized by varying degrees of irregular tremor of the hands and feet, and inability to retain the fingers and toes in a constant position. The prognosis in these unfortunate cases is never good. The lesion is fixed and central, and while others have reported relative success from electro-therapeutic treatment, the writer has never known a case to improve. If an effort is made, it should be along the same lines as in other spasmodic cases, and but little encouragement should be given.

TORTICOLLIS (WRY NECK).

Contractions of the muscles of the neck may arise from myalgia or other source of local irritation, or the affection may be congenital. The former yield very promptly to sparks, the brush-discharge, or wave current, if treated before a chronic condition of muscular shortening is established. The congenital cases are, as a matter of course, not improved by any but surgical measures.

SPASMODIC TORTICOLLIS.

Up to the present time no central lesion has been discovered that could be associated with this painful affection, and until recently the prognosis has been grave, and is to-day in cases of more than two years' standing. If, however, these cases are treated in the early stages by the high potential modalities, few indeed may not be satisfactorily cured.

The neuropathic tendencies so often present in these patients necessitate the adoption of the constitutional, as well as the local, methods of treatment at once, as we do in epilepsy, chorea, and the occupation neuroses. The wave-current alone will succeed in very many of the early cases; but sparks will be invaluable in the treatment of cases of a few months' duration.

TREMORS.

These signs of lessened nerve force may be due to alcoholic or other excesses, overworked mental or physical conditions, or organic disease of the central nervous system.

The prognosis depends on the ability of the patient to correct the habit in the early stage, the chronicity, and the character and stage of the organic disease.

The treatment is the removal, if possible, of the cause, and the employment of constitutional and local measures indicated. In most of these cases the daily administration of the usual tonic application of the wave current for from twenty to thirty minutes, followed by a mild general administration of short sparks, closing the treatment with a rapid application of friction sparks to the whole body, will be most effective. This

plan of treatment will meet the requirements satisfactorily in cases due to functional derangement, and greatly benefit, but not cure, cases of paralysis agitans, and multiple sclerosis. It will also often relieve fibrillary contractions of progressive muscular atrophy.

ASTHMA AND HAY FEVER.

These affections belong to the neuroses, and are more often acquired than inherited, though unquestionably there is an inherited predisposition present in very many cases.

Few, however, who have it in childhood are afflicted in later years; while on the contrary those who acquire the disease in adult life are rarely cured, except by removal to some climate adapted to their own case, if such they are so fortunate as to find.

The writer, during the past few years has been so favorably impressed with the results derived from the wave current in the treatment of these cases that he has reason to hope that patients may be made comfortable or cured by the means. Especially is this true of asthma. A patient is relieved most promptly of the paroxysm by the administration of the wave current.

Place a metal electrode having an area of from twenty to thirty square inches over the chest in front, open the spark-gap from four to ten inches, and continue the administration for thirty minutes. The amount of relief afforded in most cases is surprising, as well as the period for which the relief continues. Enough evidence has not been collected at this time to furnish any definite assurance that the results are more than palliative. The relief derived, however, warrants its use, and there are good reasons to expect that time will demonstrate cures in many early cases.

CHAPTER XIV.

STATIC ELECTRICITY IN DERMATOLOGY.

Although this field is relatively new, it is already practically demonstrated that in the wave-current and brush-discharge we

have two most valuable means of relieving many stubborn skin affections.

The actions of the two modalities in relief of these diseases are both local and constitutional, but vary materially in their respective effects.

The wave-current induces active local secretions, stimulates local metabolism, improves the nutritive processes, and at the same time provokes an active elimination of effete and irritating accumulations. The glands become active, and the circulation and other conditions are restored to the normal when only functional derangement exists.

The brush-discharge is especially valuable for its remarkable destructive effect upon germ life, due largely to the local oxidizing action of the ozone set free at the surface of application, but more particularly, we believe, to the violet rays manifestly present and to which the methods of Finsen and other recent writers attribute the results derived from solar light and the Roentgen ray.

The actions of the brush-discharge from the static machine, or the high-tension coil of the transformed street current, are (1) local destruction of micro-organisms; (2) stimulation of normal metabolism; (3) diminution of local œdema and congestion; (4) relief of local pain and pruritus; (5) secretion and excretion are seemingly promoted.

The effects upon the local conditions, when ulcerations are present, are to promote healthy granulation with a minimum of scar and to an extent unprecedented by other measures in the treatment of these conditions. The newly formed skin is even and of the texture of a young child's. When applied to carcinomatous ulceration it removes fetor, relieves painful sensations, and greatly improves superficial conditions. When hyperæmia, swelling, or œdema is present, it is often relieved to a remarkable extent by a single administration, and soon, in a large variety of cases, the local lesion disappears.

The local actions and effects suggest its application to a large variety of skin diseases—in few indeed does it seem not to be indicated.

During the past year there have been various forms of apparatus in vogue and employed with success. The step-up transformers connected in the circuit of the static induced current, by which series of short, painless sparks may be administered from either end of the coil, or a brush-discharge from an electrode consisting of a glass tube closed at one end, lined with tin-foil, is advocated by Dr. Henry G. Piffard of New York.

The brush-discharge, derived from one side of a street current transformer, employing high-vacuum glass electrodes, is used by Dr. G. Lenox Curtis of New York in the treatment of lupus and carcinoma, with most encouraging results.

The brush-discharge of negative insulation from the static machine, employing a wooden electrode (soft maple), in the hands of Dr. J. D. Gibson of Birmingham, Ala., has cured in twenty administrations a stubborn case of lupus vulgaris covering fully one-half of the face.

It seems not to matter from what source of sufficiently high potential the brush-discharge is derived, the results, as would be expected, are practically the same.

The writer for two years past has employed the brush-discharge from the soft-maple ball electrode to the treatment of lupus vulgaris, eczema, herpes zoster, hives, numerous erythemas, and acne with unqualified satisfaction.

In many diseases of the skin the local manifestation is the indication of a constitutional derangement, resulting from organic functional inactivity. In those cases in which the affection is not entirely local, excepting the specific exanthematas and syphilis, the constitutional static treatment proves of certain value, as would be expected.

The method of employing the brush-discharge in these cases is essentially the same as in other conditions, and practically the same to all local affections.

The time devoted to the administration, and the intensity of the application, must depend largely upon the experience of the operator, and will be varied in individual cases. The administration, however, must be thorough and necessary time not cut short.

The intensity of the application may be varied by the speed

of the machine, the distance from the surface at which the electrode is moved about, the presence or absence of a direct ground connection, the distance at which the ground connection is held from ball or point of electrode, and the material and character of the electrode. If a wooden electrode is used, much depends upon the quality of the wood. The grain or texture should be uniform, and possess poor conducting properties. Soft maple and whitewood are the proper substance, and may be varied by wetting the end from which the application is made. The form of the electrode will vary the character of the discharge. From the round ball it is coarse, and causes a sensation as if hot sand were thrown against the surface. When the point electrode is employed the discharge is fine, soft, and agreeable, but the desired effect is derived at the expense of time. The point electrode is indispensable in administrations in clefts, as between the fingers.

During cold weather the wooden electrode becomes less effective from the fact that such material when cold is a poor conductor. Warm the stick throughout the whole length before using, and it will be as effective as during the summer months. The writer also makes use of an electrode of turned

FIG. 18.—Soft Maple Electrode.

soft maple, over which a test-tube fits, and provided with a handle at least one foot in length, having a screw eye in the extreme end for attaching the ground chain. This may be employed either with or without the test-tube in position, and the resistance (corresponding with the different degrees of vacuum of the Geisseler tube) varied by holding the ground chain within the hand upon the handle at different distances from the surface treated. The brush-discharge obtained by induction, when the test-tube is in position, is very smooth and mild, and at the same time effective. There is a marked difference in the sensations produced from the opposite poles when administering the brush discharge from the static machine. The discharge of negative insulation (the patient insulated and connected with the negative side of the machine) is less irritating to the patient, and, so far as observed, of a uniform violet color. The discharge from the positive, on the other hand, is very irritating, and is characterized by a mingling of violet and other discharges, which appear yellow in the light, but in a darkened room are distinctly green. The therapeutic indications for the choice of these discharges, so far as we know, have not as yet been pointed out, but furnish a field for investigation of particular value, we believe, in dermatology.

A more extended discussion of this important subject will at present add nothing of interest to this chapter, which in a general way includes the whole field, the principles involved being applicable to the affections in general.

CHAPTER XV.

PSYCHICAL AND FUNCTIONAL NEUROSES.

The nervous system, under control of the mental and reflex influences, exists in such intimate relation with every physical function that the health of the organism depends upon the preservation of the normal activity of each—*mens sana in corpore sano.*

The psychical neuroses result from causes arising from both mental and physical derangements, and often tax professional skill to locate the correct relation of cause and effect.

Environment, associations, habits, and inherited neuropathic tendencies play no small part in determining the state of the individual, and cannot be ignored in considering either the prognosis or treatment.

The moral as well as the physical features require consideration in outlining the course to be pursued in the management of the neuroses In fact, the successful physician takes cognizance of the psychical side, no matter what the lesion with which he is called upon to contend. Cheerfulness and hopefulness greatly enhance the medical value of whatever remedy. Agreeable surroundings and encouragement, together with a grad-

ual return to a proper activity in some congenial pursuit which partakes to a large extent of physical exercise are conducive to the fullest measure of success in the treatment of the psychical neuroses. Rest enervates, and lessens thereby the activity of the very processes essential to restoration when forced as a therapeutic measure. Rest and massage lack initiative. The normal relations of the nervous system and the muscular or functionating organs are designed for concerted action. Neither passive motion nor rest afford an incentive to restoration, and consequently they do not induce the normal processes of nutrition. A physical agency to restore lost nerve force, and organic functional activity, must be general in its application, promoting activity in the cell structure of every part of the organism. To activity add a proper nutritive pabulum, congenial environment, and well-regulated exercise, and all indications have been served. The essential law of life is activity. The body recuperates during rest most vigorously when rest follows exercise.

The differentiation of the psychical neuroses which are functional and those which are organic in character has been the source of some confusion in the past, especially among general practitioners.

The distinction, generally well marked in typical cases, often affords occasion for doubt in those which are complicated, or on the border line. Neurasthenia, melancholia, and mania are distinctive in their characteristics, but often lead one to the other, marking the advancing stages toward a chronic organic condition. Hysteria and hypochondriasis may properly be considered as symptoms of neurasthenia, but they present distinct and characteristic features by which they are differentiated.

NEURASTHENIA

This complex affection classed, as it properly is, with the neuropathic conditions, partakes in every case of some functional or organic derangement which either may have been primarily the cause of the nervous exhaustion, or has resulted from it. Whether induced by irregular habits, business requirements, or worry and trouble, added possibly to an inherited neuropathic or functional predisposition, when the breakdown is manifest it will often be difficult to decide which is the predominating cause to be removed.

The symptoms most common are insomnia, pain in the head, especially marked over the region of the medulla, anæmia, indigestion, constipation, a generally sluggish or irregular action of the organs of secretion and excretion, irregular action of the heart and præcordial pain (false angina), to which may be added the train of symptoms associated with hysteria or hypochondriasis. All may be induced by impaired nerve force, or associated with other derangements which have, to an extent, been instrumental in causing neurasthenia.

The *prognosis*, when organic disease is not present, is good. The time necessary to effect a cure depends upon the duration of the affection, the probability of removing the cause, changing the environment or other circumstances unfavorable to the patient. If agreeable home surroundings cannot be provided, these patients are best managed in an institution provided with the means of meeting every indication.

The treatment calls for removal of the cause, correction of hygiene, etc., as suggested above when considering the general management of any of the class of conditions under discussion.

The electro-static treatment undoubtedly meets more indications, and as efficiently, as any other method, because (1) it quiets nervous irritability, (2) controls local congestion—active or passive, (3) promotes general functional activity, (4) relieves pain, and (5) induces natural sleep, thereby restoring to the sufferer the conditions which lead to the re-establishment of the normal functions. Treatment of the constitutional and local conditions, whether the local lesion be abdominal, pelvic, præcordial, spinal, or prostatic is indicated. At the particular region make the application of the electrodes, when the wave current is used, adapting the size of the metal plate to the idiosyncrasies of the patient, employing an electrode large enough to permit of using a spark-gap four or more inches in length, for a proper constitutional effect, and at the

same time small enough to concentrate the effect upon the local condition.

The treatment of the local affection in this manner at one application results in the relief of both conditions.

When treating pelvic affections in women, the application made *per vaginam*, employing a cup-shaped electrode to the cervix with the bivalve or special speculum in position, serves an excellent purpose. In this case the shank of the cup electrode, lying against the speculum, causes them to act as one electrode to vagina and cervix. The wave currents administered with the electrode in such a position should be measured by a spark-gap of at least four inches, and better still in most cases six to eight inches in length.

If there is a spasmodic dysmenorrhea, adjust one of the short stems to the cup electrode, beginning with the smaller size and using larger ones with discretion on subsequent days. To cure this form of dysmenorrhea, treatment should be begun immediately following the menstrual period, and continued either daily until the next period, or daily for one week, and then every second day until one week before the end of the interval, when it should again be administered daily until the molimen is established. This plan may be kept up during subsequent months, if necessary, until the function becomes normal, the effect being to relieve nervous irritability, local and general, to remove local congestion, and restore general tone of the organ, as well as the relief of anæmia and other functional derangement. (There is probably no better method of developing an infantile uterus, if it could be instituted during adolescence.) Chronic pelvic cellulitis, ovaritis, prolapsus from atony, relaxed condition of the vagina, and general local hyperæsthesia are greatly relieved and often cured by local administrations of the wave current. In some of these conditions, as ovaritis, the local use of the brush discharge over the hypogastric and iliac regions is indicated. (See Ovaritis.)

In the male no form of neurasthenia is more stubborn to other plans of treatment than the so-called sexual neurasthenia. In these cases there may be a real or imaginary impotency, or a

condition of acute or chronic congestion of the prostate gland or seminal vesicles. To no condition is the static wave current better adapted than to the treatment of these cases.

In impotency which is due to psychical impressions or hypochondriasis, the psychical effects of static electricity, of which so much is said by those who know little of the other effects, is here recognized by all. The local vibratory action of the strong current applied in the rectum, is often described as being felt to the end of the penis. This administration should be continued for at least twenty minutes, and may be followed by applications of sparks to the perineum, and friction sparks to the penis, if the case demands it. The tonic nutritional effect of the treatment is certainly one of which the physician can conscientiously make much to the patient, and either cure him by suggestion, the physical effect of the current, or both.

In the treatment of prostatitis, acute or chronic, the idea of suggestive therapeutics fails, but the result from wave current administrations in these cases is triumphant indeed. The application should be made by an ordinary metal electrode of metal or a special one about five inches in length adapted to fit the conformation of the glands and reach to the seminal vesicles.

The spark-gap in these cases should be regulated, as in all painful and inflammatory conditions—gradually increasing it as tolerance permits. The application of the current in this region should allow before the close of an administration, the use of a spark-gap of from six to twelve inches.

The effects upon the local conditions are to promptly relieve the symptoms of congestion, pressure, and irritation, with prompt restoration to health. No cases which have come under the writer's observation have afforded him greater satisfaction than the cases of prostatitis treated by the wave current. The cases of neurasthenia arising from this cause, as a rule, need no other treatment and are promptly relieved of the nervous conditions upon the institution of treatment.

Sensitive conditions over the vertebral column are relieved by the wave current, brush discharge, or sparks locally applied.

Præcordial pain, due usually to high arterial tension or

anæmia, yields promptly to the application of the wave current. (*See* Angina Pectoris.)

Constipation is undoubtedly a common cause of neurasthenia, as are also indigestion and some pelvic derangements. Systematic applications of the wave current followed by long sparks, especially over the colon, are energizing, but often require considerable time to effect a cure. Diet, mild laxatives, liberal ingestion of water, and regulation of habit, with static administrations, bring about the desired result in the shortest time and most effective manner. Secretions become more active, and tone is restored with a return of the normal peristaltic activity.

A method of treating habitual constipation by the static currents, brought to the writer's notice in a paper read before the New York School of Physical Therapeutics by Dr. Sigismund Cohn, and published in the New York Medical Journal of September 6, 1892, has been demonstrated to be of so great value that we quote the following extract in full from the paper:

"I use static electricity, either in the form of the wave current or of the static induced current; the first in the milder forms of constipation, the latter in the very obstinate cases of long standing. The polarity is in so far of importance as that the positive pole has a stronger effect on the tissues it is in contact with than the negative pole.

"In using the static wave current the patient is in contact with one pole only while the other one may be grounded or not. If we use a current without grounding, the treatment is a very mild one. By grounding we make the current considerably stronger. The contact with the patient is made either by the rectum (the patient sitting on the upright rectal electrode) or by the abdominal walls (tin foil plate, 8" x 10"). The current strength is regulated by the spark-gap between the sliding poles.

"The static induced current enables us to use very powerful means without causing the patient any pain. The static induced current, is, in reality, a current of high tension and high frequency. While the static wave current distributes its strength over the whole body, the static induced current concentrates its whole strength between two points of the body. The patient is connected with the outer surface of the Leyden jars, while the inner surfaces are connected with the poles of the machine. One electrode is generally on the abdomen, the other one either in the rectum (direct) or on the back (percutaneous). The current strength is also regulated by the spark-gap. As the patient need not be insulated, we can also use the labile method.

"The powerful action of this current, as well as that of the wave current may be enhanced by a mode of administration called the undulating or swelling current. By this we understand a current that, starting from zero, gradually swells to a maximum of strength and returns in the same way to zero. By alternately increasing and decreasing this current we produce in the muscles alternations of wavelike contractions and relaxations. The effect of this mode of administration of the current is a tonic exercise of the muscles, and in using it we do not risk the danger of overworking and exhausting the muscles, as its maximum contraction is only of short duration. The circulation of the blood and lymph will certainly be accelerated by this milking like process, and we can readily understand how the atonic condition of the tissues is improved. On the static machine we get the swelling current by slowly removing one pole from and then approaching it to the other."

The disturbances of the secretory and excretory functions, inactive or excessive, as the case may be, are caused by lost nervous tone, and normal activity is restored by the general treatment.

Insomnia, one of the most persistent and aggravating symptoms, soon yields to the long constitutional treatment, many of these patients falling asleep during the administration. The general relaxation, lowered arterial tension, with lessening of nervous irritability, induced as they are, afford the conditions favorable to sleep. For best results, the treatment should be given at night before retiring, if but one administration is given daily. Patients in whom nervous irritability is extreme should be given two half-hour sittings daily. In but rare instances

will the noise of the discharging sparks of the wave current unfavorably affect these cases. On the contrary, it is soothing to far the greater proportion of patients, as soon as any nervous apprehension which may be present is removed by convincing them that no possible harm can come from the use of such currents. Another precaution in these cases is to employ an electrode of sufficient size, that no unpleasant vibration can annoy them, for which purpose a metal plate 6 x 10 or 12 inches, placed next the integument upon the abdominal or lumbar region, whichever is most convenient, may be employed.

Insomnia will be incidentally overcome in most patients during the treatment of local conditions.

A remarkable fact will be almost invariably observed in the neurasthenic patients in the action of the sweat glands. For the first three, and with some patients even five prolonged daily administrations, there will be no sensible perspiration either beneath the metal electrode or upon other portions of the surface. When it does finally appear, it will be present with subsequent applications. The same observation will be made in very many patients taking teatment for other affections, showing a tendency of this function to become inactive. It is a significant fact in most cases that a remarkable improvement in the constitutional condition takes place coincident with the resumption of this function, probably from the fact that other functions are restored to a greater degree of activity at the same time. Lost appetite returns, the patient becomes less irritable, and in most cases sleeps better during the first week. In those in whom the peripheral circulation is inactive, the administration of sparks, especially the friction sparks applied rapidly over the whole surface of the body, is productive of the desired result.. Other conditions existing with neurasthenia, and the allied neuroses, call for the same general *rationale*.

HYSTERIA.

Hysteria is an impaired functional disease characterized by lost individual control, either mental or physical, or both, and

marked by varying degrees of anæsthesia, hyperæsthesia, paralysis, contractions, or other perverted conditions. It arises from inherited predispositions, physical derangements, evil associations, and improper moral training leading to habits of indulgence often associated with a petulant, selfish disposition, which under disappointment, reverses, or other disturbing influences cause the individual to become a helpless invalid. They often do not receive needed support and proper sympathy from their relatives and friends who, from the popular notions, consider the condition one of shamming when in reality it is not. Few patients are victims of conditions demanding more skillful attention than these. The moral management is of great importance and demands an exercise of tact, with firmness, system, and the administration of measures of relief which exert positive physical effects from which the patient may derive the necessary reassurance. As in the neurasthenic conditions above considered, and for the same reasons, electro-static administrations are particularly indicated in hysteria. The heroic application of sparks to those patients whose condition has resulted from overindulgence and petting serve, when administered under pretext of necessity, a most efficient therapeutic purpose.

Areas of anæsthesia should be treated each time by the application of friction sparks until sensation returns and the patient protests. Over paralyzed muscles and contractures apply sparks, or if the patient is feeble make use of the wave current.

Treat all other conditions according to the indications, observing in all cases the importance of the constitutional administrations of the wave current for periods of not less than twenty minutes at each daily treatment.

HYPOCHONDRIASIS.

This neurosis is defined by Gowers as "a morbid state of the nervous system in which there is mental depression due to erroneous ideas of such bodily ailments as might conceivably be present." This state is termed hypochondriasis in men only, according to this writer, and when in women as forming part

of hysteria. Again when the extremity of the delusion becomes such that the impression is fixed, that the imagined condition is actually present, it should be termed insanity. Melancholia is present in this condition almost constantly, with an inordinate brooding over an imaginary condition. When the borderline between actual insanity is crossed in a given case, it is most difficult to discern, and most important on account of the danger of self-destruction.

In the ætiology of this condition timidity plays an important part, either as a neuropathic predisposition to tendencies, habits, or practices which vitiate and lead to a weakening of the mental poise, or from the fact that the mental status in the individual is abnormal from birth. Undoubtedly environment and the evil associations of youth pervert and destroy the normal status and lead to physical depravity in many cases as well. Dyspeptic troubles, which are so common in those with whom the care and hustle and bustle of business make such drafts upon their energies, together with the pernicious effects of quick lunches, constipation, and excessive use of stimulants, once established, lead to a most common variety of hypochrondriasis. This type, under systematic management, is most amenable to treatment. Few indeed of the derangements of digestion cannot be relieved and cured under present systematic methods.

In a class of individuals who know just enough of their organization to imagine ills and evils which cannot exist, apprehension, fear, and attention to every reflex pain or other sensation discover ailments which are as real as if actually present. Dyspepsia, constipation, and the associated annoying discomforts of reflex palpitation, præcordial pain, movements of gases in the alimentary canal, and all manner of disturbing symptoms, awaken fear of dangerous organic disease, and are followed by the consequent solicitude and despondency. Such conditions in the writer's experience are not peculiar to men. The same affection arises also from real or imaginary impairment of the sexual function in the male. In such it is caused, as suggested above, by masturbation, excess of venery, and is probably more common

than from all other sources combined. The reading of the infamous literature poured out from all directions by a disreputable class of charlatans who prey like vultures upon the uneducated and gullible youth and adult for the sale of electric belts and other nostrums in themselves useless. It is hoped that the government will yet put a stop to such use of the mails, which is in itself worse than counterfeiting, blackmail, or the getting of money by illegal stock transactions because it not only gets money by false representation, but destroys and vitiates the public mind.

The treatment of hypochondriasis depends upon so many causes requiring, not alone physical measures, but in many cases moral restraints and proper environments, that but partial justice can be done to the subject here. Attention to the digestive function when due to an actual gastritis, which should be differentiated by chemical analysis of the stomach contents, is indicated. Atonic or so-called nervous dyspepsia will be successfully treated in most cases by applying a large (4 x 8 inch) metal electrode over the epigastrium, and administering the wave current with a spark-gap of four to ten inches in length. In gastroptosis, place the electrode over the displaced stomach and employ the same current and sparks. In all other respects use the same measures as indicated in the kindred cases described in this chapter.

Undoubtedly institution management for these patients is best calculated to meet all indications, both moral and physical.

MELANCHOLIA.

This condition is properly a symptom associated in varying degrees with each of the neuroses included in this chapter, and calls for no special indications for treatment not included in the preceding considerations.

FUNCTIONAL INSANITY.

By the above term we would include a large number of cases of mental derangement which arise from neurasthenia, hysteria, hypochondriasis, or other causes as fright, anxiety, or trouble,

or occurs primarily in persons who suffer from impairment of general health, in which no organic lesion of the brain is present.

The condition may be manifested by delusions, persistent melancholy, or emotional states in connection with which the patient may be thrown into fits of crying, laughing, or aimless movements of the extremities. The patients are apt to be sensitive to a strong light, and are annoyed by slight noises which under ordinary circumstances would not be noticed. Headache is a more or less constant symptom. The peripheral circulation in a large proportion of these patients is feeble, they suffer from cold hands and feet, inactive secretions, and are usually of a constipated habit. There is also apt to be a more or less constant condition of high arterial tension. The flushed face, injected conjunctivæ, headache and hypersensitiveness, and insomnia so often present are indicative of intercurrent cerebral hyperæmia, which is undoubtedly present in most of these patients.

The indications for the employment of electro-static administrations in these cases is apparent and the result most gratifying. The method is practically the same as in neurasthenia, observing the indications for treatment of any local condition that may be present.

The same rule should be observed in treating headache of the congestive type, *i. e.*, during the administration of the static bath, or wave current, the point of the stand electrode should be placed on a level with the knees, and at a distance that will cause a moderate, not disagreeable warmth beneath the clothing. This method determines in great measure a current flow from the head and serves as a derivative, relieving the cerebral hyperæmia.

The wave current, administered for at least one-half hour daily, is the best plan of treatment in these cases, but the noise, as a rule soothing, in a few instances will at first aggravate the patient. With these patients substitute static insulation for a few days, and later they are certain to become tolerant to the noise induced. To improve the peripheral circulation during the first administrations of the tonic treatment, pass the brush

electrode rapidly over and around the patient at a distance that will produce a sensible warmth, or employ the brush discharge from the wooden ball electrode (negative insulation), and later, when the patient becomes tolerant, thoroughly apply the friction sparks to the whole surface of the body.

The results from the above plan are, in most cases, gratifying. We believe that static administrations are calculated to benefit many types of insanity, and trust that the future will find the machines in daily use in all the great institutions of the country.

CHAPTER XIV.

MISCELLANEOUS DISEASES: TUBERCULOSIS.

Tuberculosis, characterized by the presence of the tubercle bacillus, exists as a local affection, and may be present at the same time in one or more of the structures of the body.

Pulmonary tuberculosis, the most common form of the disease, has, in the first and less often in the second stage, been cured by measures which increase the powers of resistance and restore to a degree the normal nutrition with increased weight and gradual return to a state of health. The bacillus cannot exist in a healthy organism, and is never actively present until, for some cause, health and vitality have been impaired.

Any influence, especially in persons having an inherited predisposition, that reduces the vitality, predisposes to the onset.

The indications are twofold: (1) to destroy the bacilli at the site of invasion, and (2) to improve the health and powers of resistance of the patient.

The prognosis will depend (1) upon the stage at which the disease is recognized, (2) upon the character and extent of the cause, (3) upon the institution of proper restorative measures and their faithful employment. No single plan of treatment is applicable to every case, and no one measure sufficient to meet the indications. Of the province of electro-static administrations in consumption much has been written. The

virtue of so-called static cataphoric administrations has little foundation, we believe, in fact. On the contrary, there is sufficient evidence to show that the static administrations act chiefly to improve the functional activities of the patient and thereby facilitate return to a normal condition. It is upon this assumption, now well founded, that we will, in what follows, base the grounds for the employment of the static modalities in meeting the second of the above indications.

The first indication, when the lesion is of the lungs, is most difficult to relieve. The French, and some American writers, have contended that ozone may be brought in contact with the lesion and destroy the bacilli at the site of invasion. Dr. J. D. Gibson, of Birmingham, Ala., has shown that positive improvement is derived from inhalations in conjunction with allied measures.

If ozone can be brought in contact with infected areas, its effect upon the bacilli of tuberculosis is undoubtedly to destroy them, as is amply illustrated in the treatment of lupus vulgaris. At the present time attention is drawn to the employment of the Roentgen ray in the treatment of tuberculosis, both the pulmonary and other local forms of the disease. To date, we believe, nothing of a positive nature is established that will warrant more than the suggestion.

For the purpose of improving the general status in the management of every case, particular attention should be given to the sluggish or deranged physical function. Place a metal electrode over the organs in question and with the wave current give half-hour administrations, bearing in mind that by such means the patient will at the same time derive the desired constitutional effect, and if ozone is, as we believe it is, beneficial, the patient will breathe an atmosphere impregnated with it from the constantly discharging spark at the spark-gap.

This plan of treatment, followed daily with careful attention to every function, together with care of the diet, environment, regulated rest, and exercise, will contribute in a large degree to the recovery of these unfortunate patients.

Tubercular joints and glands will not be benefited by the local administration of the wave current or sparks. There are

reasons to believe, on the contrary, that these conditions are aggravated by the local static administrations.

If it were possible that the discharges of the brush-discharge were penetrating, as some would teach, the local effects of the ozone would certainly exert a curative action as it does in lupus, but experience disproves the notion.

Tubercular laryngitis, we believe, will be materially benefited by the administration of the brush discharge, employing a special electrode, which must be insulated with vulcanite where it passes the fauces, or by employing the discharges from a vacuum tube.

Tubercular enteritis. There is no reason to suppose that any administration will favorably affect this fatal complication.

Lupus vulgaris yields most satisfactorily to the administrations of the brush discharge. (See chapter on Dermatology.)

CHLOROSIS AND ANÆMIA.

Chlorosis and anæmia may be considered for our purpose together, for both are secondary conditions arising from menstrual derangements in young women, infective or febrile diseases, chronic suppurative diseases, nephritis, dysentery, pregnancy, and other affections which make excessive draught upon the physical resources. The proportions of the normal constituents of the food become altered and the relative number of the red blood corpuscles are especially reduced.

The indications are (1) removal of the cause, (2) iron and nutritive foods, (3) any agency that will induce functional activity without producing otherwise deleterious effects.

The prognosis is dependent upon the primary condition, and is especially good in all cases not complicated by serious malignant suppurative or organic affections.

The treatment of menstrual derangements characterized by the presence of passive pelvic congestion, spasmodic and other nervous conditions which are amenable to the local measures employing the wave current, sparks, and brush discharge has been described in the previous chapter, when treating of the same conditions complicating hysteria.

The writer's attention was first called to the remarkable disappearance of anæmia when treating other conditions, in a clinic practice in which it as the rule to make use of no means other than electricity. In these patients, as the bowels became regular, and the other functions more active, the anæmia gradually disappeared. In private practice the same result is invariable where no organic, malignant, or suppurative disease is present coincident with the restoration of the normal functions.

The method of application must be governed by the conditions present, and the electrodes placed as indicated in the treatment of the peculiar constitutional and nervous affections.

DIABETES MELLITUS.

There are at present not sufficient data upon which to base positive indications or results in a sufficient number of cases to warrant more than suggestions. We would employ the wave current, placing an electrode of a surface area of about 5 x 8 inches over the region of the pancreas, regulating the spark-gap to the patient, as a rule making it four to eight inches in length. Such administrations should be made at least thirty minutes daily and in no wise contra-indicate the medical treatment of the disease.

If the lesion is congestive in character and of the pancreas, and the treatment instituted before structural organic changes have taken place, we have the best reason to expect a restoration of the normal conditions.

BRIGHT'S DISEASE.

The different forms of nephritis are all types of congestion, varying essentially in the part of the structure of the organ which is the site of the process. Here, as in all congestions, acute or chronic, the rule for treatment obtains.

The prognosis depends upon (1) the chronicity of the case, (2) the physical condition and habits of the patient, and (3) the particular structure of the organ which is the site of the lesion.

The principles of *treatment* in Bright's disease are in accord with the general rules of administration. Apply an electrode 3 x 9 inches over the region of the kidneys, the long dimension transversely, taking care that the metal is shaped to conform to the surface, and held in position by a pillow pressed firmly between the electrode on the person of the patient and the back of the chair. The wave current should be administered for at least thirty minutes daily, employing a spark-gap of from four to ten inches, avoiding discomfort to the patient, but bearing in mind that the efficiency of the application depends upon the relation of the current to the underlying fat and muscular structures.

At the Buffalo meeting of the American Electro-Therapeutic Association, Dr. A. D. Rockwell of New York presented a paper, which was published in the Journal of Advanced Therapeutics for January, 1902, in which he reported most gratifying results in the treatment of several cases of Bright's disease by the high-tension coil and wave current, wherein he expressed his preference for the latter. Under the treatment the patient's secretions all become more active, local congestion is undoubtedly relieved, and the general health of the patient improves. It is, therefore, a most rational measure, either alone or in conjunction with other therapeutic means which seem to be indicated.

CONGESTIONS OF THE LIVER.

Without entering into particulars as to the various congestions of the liver, active or passive, which, for the purpose of treatment, we consider in all to be practically the same, the prognosis in each depends upon the possibility of removing the cause, and the chronicity of the lesion.

In all visceral congestions the indications for electro-static administrations are practically the same as have been described when treating of nephritis, and the results warrant its general adoption.

The wave current is the modality of great value, but in all acute conditions should be supplemented by an administration

of the brush discharge to the extent of producing the rubefacient effect over the region of congestion. The operation will consume considerable time, but the result will amply reward the expenditure.

MYASTHENIA GASTRICA.

The local and tonic stimulating effects of the electro-static modalities, especially of the wave current and sparks, upon myasthenia gastrica are most remarkable and particularly adapted to other associated conditions. In no case will it favorably affect a catarrh of the stomach, but atony and relaxed conditions respond as to no other plan of treatment.

A potent administration of the wave current for from twenty- to thirty minutes, followed by a liberal administration of long or short sparks—depending upon the nature of the underlying structures—will meet the requirements.

EXOPHTHALMIC GOITER.

This disease, complex as it is in the peculiarity and remoteness of the organs involved, is favorably affected in most instances by a judicious administration of the wave current. In some patients the lowering of the arterial tension seems to unfavorably affect the heart's action. In most instances, however, there is a marked relief of the tachycardia, diminution of the size of the enlarged thyroid, and a cessation of the further progress of the disease, when the treatment is systematically carried out. The application of the wave current should be both local to the thyroid and constitutional; applying the electrode for constitutional treatment over the epigastrium. Secure a metal electrode over the thyroid gland for local treatment, and employ as long a spark-gap as will be permitted without causing unpleasant contraction of the laryngeal muscles, and continue the administration for from fifteen to twenty minutes. Follow this with the tonic treatment for a length of time depending upon indications, but not less than twenty minutes.

SIMPLE GOITER.

This form of goiter, before hyperplasia takes place, may be invariably cured by a few administrations of the wave current applied to the gland, as in Graves' disease, and considerably reduced in all cases.

CONCLUSION.

In these chapters it has been deemed not necessary to refer to every condition in which the high potential modalities are indicated, but by the classification adopted an effort has been made to treat the subject in such a manner that, by observing the general principles of technique, the reader may carry it into the broader field of general application.

To many who are familiar with the other electrical modalities, some expressions may appear narrow. Such will note that we were treating especially of the electro-static modes of administration, and have confined the work to the consideration of that subject.

If the writer's experience as set forth is confirmed, as we are satisfied that it will be generally, we trust that the work will contribute somewhat towards breaking down an unwarranted prejudice against a valuable therapeutic measure.

INDEX.

Abrasions call for care, 59
Administrations, frequency of, important, 55
Administrations, forms of, 21
Affections, peripheral, 97
Allen, Dr. A. H., 90
American apparatus, 5
Angina pectoris, 84
Anæmia, treatment of, 122
Anterior poliomyelitis, 90
Antiseptic, brush discharge, 30, 49
Apparatus of d'Arsonval, 6
Argyll Robertson pupil, 97
Arthritis, rheumatoid, 60
Asthma, 103
Athetosis, prognosis of, 101

Bell's palsy, 93
Blanched spot, 49
Blepharospasm, 98
Bordier, Dr., 5
Breeze, technique of, 27
Breeze, physiological action of, 49
Bridging defined, 55
Bridging, importance of, 56
Bridging, in sciatica, 72
Bright's disease, 122
Brush-discharge, action of, 104
Brush-discharge, advantage of, 30
Brush-discharge by induction, 106
Brush-discharge invaluable in skin diseases, 30
Brush-discharge in inflammatory diseases, 30
Brush-discharge in lupus, 105
Brush-discharge in dermatology, 104, 105
Brush-discharge in gout, 63
Brush-discharge in brachial neuritis, 73
Brush-dischargo in paralysis, 95
Brush-discharge in torticollis, 102
Brush-discharge in carcinoma, 105
Brush-discharge in pelvic affections, 72
Brush-discharge in functional insanity, 119
Brush-discharge in tuberculosis, 121
Brush-discharge in congestions of the liver, 124
Brush-discharge, physiological actions of, 49
Brush-discharge, pole employed, 106, 107
Brush-discharge, source of, 105
Brush-discharge, technique of, 28
Brush-discharge, varied, 105, 106
Brush-discharge vs. breeze and spray, 30

Cardialgia, 83, 84
Care of the machine, 15
Carcinoma, brush-discharge in, 105
Case of static machine closed against moisture, 10
Cataphoresis practically impossible, 47
Cauterization impossible, 47
Change in Faradic batteries, 6
Charcot, 21
Charging the machine, methods employed, 18
Charging the machine, provision favorable for, 11
Chemical action insignificant, 47
Chlorosis, 121, 122
Chorea, 99
Classification of subjects, plan of, 56
Cleaves, Dr., water rheostat of, 33
Coccygodynia, prognosis and treatment of, 80
Coil demanded, 9
Coil for X-ray, 9
Cohn, Dr. Sigismund, 112
Conclusion, 125
Conductive discharge, 21, 30
Congestion relieved, 48, 49
Congestions of the liver, 123, 124
Constipation, 112

Contact with street current to be avoided, 21
Contractures from paralysis, 94
Contractions, muscular, 96
Contracture, 96
Contractures, cause of, 100
Contracture, treatment of, 100
Contracture in hysteria, 101
Convective discharges, 21
Convective forms of administrations, technique, 26
Convulsions, 96
Convulsive tic, 98
Convulsive tic, treatment of, 98
Currents of great frequency of d'Arsonval, 7
Current of sinusoidal machine, 7
Current controller, 14
Currents of Morton, 31
Currents of great frequency, light potential, and small quantity, 34
Currents of high frequency and small quantity having frequency of oscillation under control verses currents of d'Arsonval, 34
Curtis, Dr. G. Lenox, 105

Danger from employment of Franklinism, 47
Damp house objectionable, 15
d'Arsonval currents introduced after static induced, 31
d'Arsonval apparatus, 31
Dermatology, 103, 104
Dermatology, wave current in, 104
Dermatology, brush-discharge in, 104, 105
Diabetes, mellitus, 122
Discovery of Roentgen ray added another field, 8
Disruptive discharges, 21
Disruptive methods, 18
Du Bois Raymond's law, 47
Du Bois Raymond's law, qualifications of, 48
Dosage, how regulated, 54

Effects, constitutional, of various modalities, 51
Effects, constitutional, of static induced current insignificant, 52
Effects, local, of wave current, 48
Effects, local, of sparks, 49
Effects in syphilis, 51
Effects in gonorrhea, 50
Effects upon tuberculosis, 50
Effects upon contusion, sprains, synovitis, etc., 50
Effects of static modalities upon hyperæmia, congestion, and pain important, 50
Effects of friction sparks, 25
Effects of static electricity upon phthisis, 58
Effects upon necroses, 58
Effects of brush-discharge in dermatology, 104
Effects, tonic, of wave current, 83
Effect of static modalities upon germ life, 58
Effects upon nervous irritability, 51
Effects upon respiration, 51
Effects upon circulating apparatus, 51
Effects of currents of small quantity, great frequency, and high potential, 47
Effects, derived, show value of static modalities, 47
Effects of intervening material between surface of patient and electrode, 43
Effects of wave current on secretions, etc., 114, 115
Effects on pain of tabes, neuralgia, and migraine, 50
Electrodes necessary, 12
Electrodes, special metal plate for platform, 14
Electrode roller, use of, 25
Electrode ball for friction sparks, 25
Electrode point for breeze, 27
Electrode crown or tassel, 27
Electrode, Fig. 6, brush, 27
Electrodes of wood in brush-discharge, 29
Electrodes when employing the wave current, 43
Electrodes, special, for wave current, 43
Electrodes, material of, 44
Electrodes, thickness of metal for, 44
Electrodes cut in various shapes to conform to parts, 66
Electric heater for drying, 16
Electrification interrupted, 26

Electrolysis practically impossible, 47
Experiment with mouse, 53
Elimination increased, 51
Epilepsy, treatment of, 97

Flat foot, 82
Forms of administration, 21
Franklin, Benjamin, 21
Friction sparks of great value in locomotor ataxia, 78

Gastralgia, 83, 84
Gibson, Dr. J. D., 105, 120
Goiter, exophthalmic, 124
Goiter, simple, 125
Good ground imperative for wave current, 44
Golden rule, 55
Gout, method of treatment, 63
Goutty affections, 60
Great value of currents administered with patient insulated, 48
Grounding, methods of, 20
Ground connections, 20

Hay fever, 103
Headache, 87
Hedley, Dr., 5
Hospital, static electricity in, 9
Humidity affects all machines, 15
Humidity partially obviated, 15
Humidity controlled by cooling operating room, 16
Humidity, effect of, on wave current, 43
Hygrometer, 14
Hyperæmia and congestion, conditions associated with, 56
Hyperæmia and congestion, 81, 82
Hypochondriasis, 116
Hypochondriasis, treatment of, 117
Hysteria, 115

Idiosyncrasy of patient, 54
Inflammatory conditions, technique of treatihg, 58
Inflammatory conditions, classification of, 57
Inflammatory conditions, 57
Insanity, functional, 118
Insane asylum, static electricity in, 9
Insulated platform, 12, 42
Insulation versus wave current interrupted, 26
Insomnia, 113, 114
Interior construction of static machine, 10

Laryngitis, tubercular, 121
Length of spark-gap relative to effect sought, 43
Leyden jars for static induced current, 12
Leyden jars, portable, 10
Liver, congestions of the, 123, 124
Liver, neuralgia of, 83, 84
Locomotor ataxia, ætiology of, 74
Locomotor ataxia, pathology of, 74
Locomotor ataxia, symptoms of, 74
Locomotor ataxia, prognosis of, 74
Locomotor ataxia, indications and treatment, 76
Lupus, brush-discharge in, 105, 121

Marked redness after sparks, 49
Melancholia, 117, 118
Metabolism increased, 49, 52
Metal plate, position of, 22
Medical profession skeptics, 8
Migraine, 85, 86
Modalities, in spasmodic torticollis, high potential, 102
Moisture absorbed by cracked ice and salt, 15
Moisture absorbed by calcium chloride, 16
Moisture absorbed by quicklime, 16
Morton, Dr., 6, 21
Muffler for use with spark-gap currents, 14
Muffler, in interrupted insulation, 26
Muffler, Fig. 5, 27
Muffler, with wave current, use of, 45
Muscular contraction, induced, 48
Muscular spasm relaxed, 48, 49
Muscular contractions, 96
Muscular contractions, classifications of, 96
Muscular contractions, indications of, 96, 97
Myalgia, method of treatment in, 63
Myasthenia gastrica, 124

Nollet, Abbé, 21
Neuralgia, symptoms of, 79
Neuralgia, treatment of, 80
Neuralgia, intercostal, 81
Neuralgia, facial, 81
Neuralgia, plantar, 82
Neuralgia, visceral, 83
Neuralgia, 83
Neuralgia, ovarian, 84, 85
Neuralgia of the rectum, 83, 85
Neuralgia of testicle, 83, 85
Neuralgia of kidneys, 84
Neurasthenia, 109
Neurasthenia, symptoms of, 109
Neurasthenia, treatment of 109
Neurasthenia, sexual, 111
Neuritis, causes, treatment, etc., 69
Neuritis, within the pelvis. 72
Neuritis, brachial, 73
Neuritis, facial, 74
Neuroses, painful, general consideration of, 69
Neuroses, painful, 57
Neuroses, occupation, 99
Neuroses, occupation, treatment of, 100
Neuroses, psychical and functional, 107, 108

Œdema following fracture, 50
Occupation neuroses, 99
One pole current, 7
One pole current, electrifies the whole body 35
Osler, Dr., 83
Osteo-arthritis, treatment of, 67
Osteo-arthritis, diagnosed by the X-ray, 67
Osteo-arthritis, diagnosis of, 67
Orthopedic appliances in treatment of contractures, 101
Operating chair, 12
Ovary, neuralgia of, 83, 84,
Ozone attacks hard parts of machine, 16

Pain, local, relieved, 48, 49
Pain, precordial, 112
Paralysis, 57
Paralysis, general treatment of, 87, 95, 96
Paralysis, caused by brain lesions, 88
Paralysis, peripheral, 88, 94
Paralysis, from traumatism, 89
Paralysis due to congestive lesions, 89
Paralysis, facial, 93
Paralysis from syphilis, 93
Paralysis, trophic centers in, 93
Paralysis, diet in, 94
Paralysis, contractures from, 94
Paralysis, wave current in, 95
Patient's position when administering sparks, 32
Patient's comfort to be consulted, 45
Patient, management of, when employing wave current, 45
Patients become drowsy, 51
Patients lassitude, 51
Patients intimidated, 52
Patient comes skeptical, 52
Patient's fears, how calmed, 52
Patients aroused by accidents, 53
Patients should be relieved at first sitting, 53
Patient's say so important, 55
Pelvic affections, 97
Peripheral affections, 97
Physiological effect of currents, general, 31
Piffard, Dr. H. G., 49, 105
Podalgia, 82
Platform, position of, 22
Polarity, change of, 20
Polarity, how determined, 20
Polarity of wave current, 44
Polarity, varying effect of, 87
Poliomyelitis anterior, 90; treatment of, 91, 92
Principles, general, of static administration, 52
Progressive improvements, 5

Receptacle for Ca Cl_2 or Ca O, 12
Rectum, neuralgia of, 83, 85
Relative merit of static machine and coil for X-ray, 9
Relative merit of currents, 7
Rheophore when administering the wave current, 43
Rheumatic affections, 60
Rheumatoid arthritis, 60; method of treatment, 64
Rheumatism, method of treatment, 60
Rockwell, Dr. A. D., 123
Rubefacient, brush discharge, 30, 49

Sciatica, treatment of, 70
Sciatica, good prognosis of, 70

Sciatica, spark-gap regulation in, 71
Secretion of sweat, 48
Secretion inade active, 51, 114, 115
Secretion, errors of, 57
Secretion usually at first inactive in neurasthenia, 54
Sensitive conditions over the vertebral column, 112
Size of electrodes, 43
Size of electrodes relative to effect sought, 43
Skin, mottled, 54
Skin, blisters of, 54
Skin diseases, constitutional treatment of, 105
Static insulation, 26
Spark-gap currents of Dr. Morton, 6
Spark length regulated in various ways, 22
Spark technique, 23
Spark director, 23
Spark, Leyden jar technique, 26
Spark-gap distinctive features of all static currents as shown by Morton, 31
Spark-gap, length for wave current, 44
Spark-gap, length may depend on, 45
Spark-gap, lengthening increases contractions, 48
Spark-gap regulation of, in sciatica, 71
Spark-gap in epilepsy, 97
Spark-gap in convulsive tic, 98
Spark-gap in blepharospasm, 98
Spark-gap in hiccoughs, 99
Spark-gap in occupation neuroses, 100
Sparks, employment of, 21
Sparks, negative or positive, 21
Sparks, rows of, 23
Sparks to hollows or angles, 23
Sparks, features of, 23
Sparks, painful over bony prominences, 23
Sparks painful to breasts, genitals, and finger nails, 24
Sparks, classified, 24
Sparks, indirect technique of, 24
Sparks, direct technique of, 25
Sparks, friction, technique of, 25
Sparks, physiological action, 49
Sparks, local effects of, 49
Sparks in sciatica, 70; in brachial neuritis, 73,
Sparks, friction value in locomotor ataxia, 78
Sparks, in paralysis, 94
Sparks, friction in occupation neuroses, 100
Sparks in contractures, 100
Sparks in hysteria, 101
Sparks in torticollis, 102
Sparks in spasmodic torticollis, 102
Sparks, short and friction, in tremors, 102
Souffle technique, 27
Spark gap in asthma, 103
Spark-gap in neurasthenia, 110
Spark-gap in pelvic affections, 110
Spark-gap in prostatitis, 111
Sparks in neurasthenia, 114
Sparks, friction, in neurasthenia, 114, 115
Sparks in hysteria, 115
Spark-gap in hypochrondriasis, 117
Sparks in functional insanity, 119
Spark-gap in exophthalmic goiter, 125
Spasmodic conditions, 57
Spasm, clonic and tonic, 96
Spasmodic dysmenorrhea, 119
Speed controller, 14
Speed, rapid for brush discharge, 29
Speed increases contractions, 48
Spray with brush electrode for introducing timid patient, 27
Spray technique, 28
Spray intensity increased by woolen cloth, 28
Static cage, objections to employment, 28
Spray, psychological action, 49
Static cage, technique of employment, 27
Static cage versus wave current, 28
Sprains, 58
Sinusoidal machine, 6
Stand electrode in headache, 118
Static bath, 26
Static cataphoric administration in tuberculosis, 120
Static currents in constipation, 112
Static electricity, physiologica actions, 46, 47, 48, 49, 50, 51 52

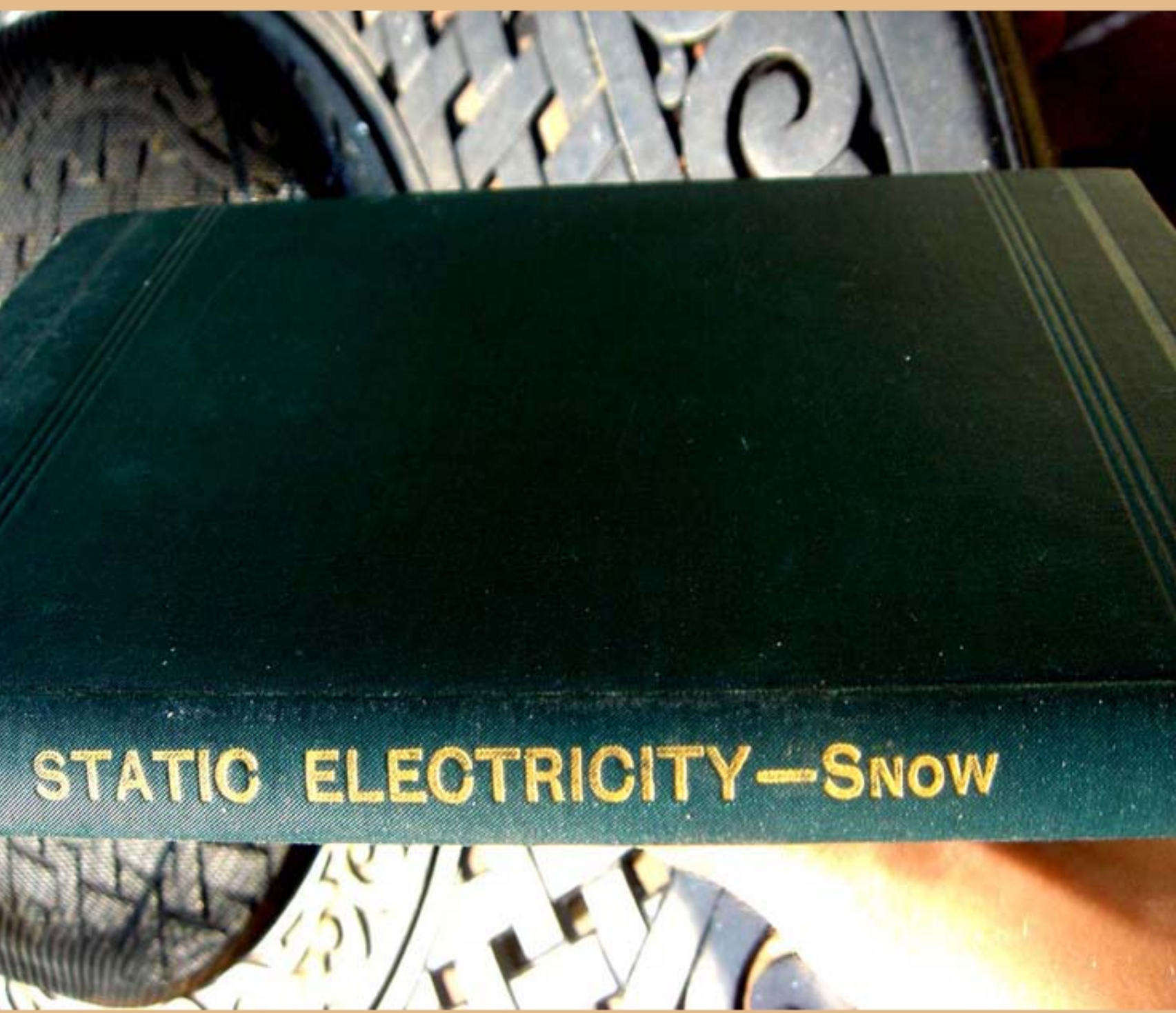
Static electricity in insane asylums and hospitals, 9
Static induced current, physiological action of, 49
Static induced current in constipation, 113
Static induced a two pole current, 7
Static induced current, history of, 31
Static induced current, technique of, 32
Static induced current most adaptable of two pole currents, 35
Static induced current, Leyden jars for, 12
Static insulation in functional insanity, 119
Static machine preferred for X-ray, 8
Static machine general consideration of types, 10
Static machines, test of efficiency, 12
Static machines, location of, 15
Static machines, renovation of, 17
Static modalities considered to be placebos, 47
Static modalities, local effects, 48
Static modalities, constitutional effects, 48
Step-up current, 34
Step-up transformers, 105
Summary of constitutional action, 52
Swelling currents in constipation, 113
Synovitis, treatment of, 68

Tassel, 27
Technique of treating inflammatory conditions, 58
Tesla transformer, 34
Tesla coil, 49
Testicle, neuralgia of, 83, 84, 85
Tetanus induced, 48
Tic douloureux, 81
Tinsel braid in anterior poliomyelitis, 95
Torticollis, 102
Torticollis, spasmodic, 102
Transformers, step-up, 105
Transformers, street-current, 105
Tremors, 96, 102
Tuberculosis, 119
Tubercular joints and glands, 121
Tubercular laryngitis, 111
Tubercular enteritis, 121
"Two pole" static induced current, 7
"Two pole" current, a relative term, 35

Vigoreaux, 21

Water and gas pipes for grounding, 20
Watches to be removed, 45
Wave current a one pole current, 7, 35
Wave current, versus interrpted insulation, 26
Wave current versus static cage, 28
Wave current versus brush discharge, 30
Wave current, physical action of, 85
Wave current excites activities, 35
Wave current, physical local effect, 36
Wave current, history of, 36
Wave current modification (Morton), 36
Wave current intensified by external capacity, 37
Wave current intensified by connection employing Leyden jar, 37
Wave current modifications, 38
Wave current modifications compared, 39
Wave current, effects upon hyperæmia and congestion and pain discovered, 42
Wave current technique, 42
Wave current, local effects, 48
Wave current in rheumatoid arthritis, 65
Wave current in sciatica, 70
Wave current in neuralgia, 80
Wave current, tonic effects of, 83
Wave current in anterior poliomyelitis, 91, 92
Wave current in paralysis, 95
Wave current in epilepsy, 95
Wave current in convulsive tic, 98
Wave current in blepharospasm, 98, 99
Wave current in hiccoughs, 99
Wave current in occupation neuroses, 100

Wave current in contractures, 101
Wave current in hysteria, 101, 115
Wave current in torticollis, 102
Wave current in spasmodic torticollis, 102
Wave current in tremors, 102
Wave current in dermatology, 104
Wave current in asthma, 103
Wave current in the vagina, 110
Wave current in spasmodic dysmenorrhea, 110
Wave current in sexual neurasthenia, 111
Wave current in prostatitis, 111
Wave current in constipation, 112
Wave current in insomnia, 114, 115
Wave current, effect of, on secretions, etc., 114, 115
Wave current in hypochondriasis, 117
Wave current in functional insanity, 119
Wave current in tuberculosis, 120
Wave current in tubercular joints and glands, 121
Wave current in diabetes mellitus, 122
Wave current in Bright's disease, 123
Wave current in congestion of the liver, 124
Wave current in myasthenia gastrica, 124
Wave current in exophthalmic goiter, 124, 125
Wave current in simple goiter, 125
Wesley, John, 21
Wet clothing and certain fabrics absorptive, 24
Woolen cloth or paper intensifies discharges, 24
Wrist movement when administering sparks, 23
Wry neck, 102


STATIC ELECTRICITY—SNOW

C. W. & R. M. BOWEN CO.,

Static Machines.

X-Ray Outfits and Supplies.

HIGH GRADE

Electro-Therapeutic Apparatus

PROVIDENCE, R. I.